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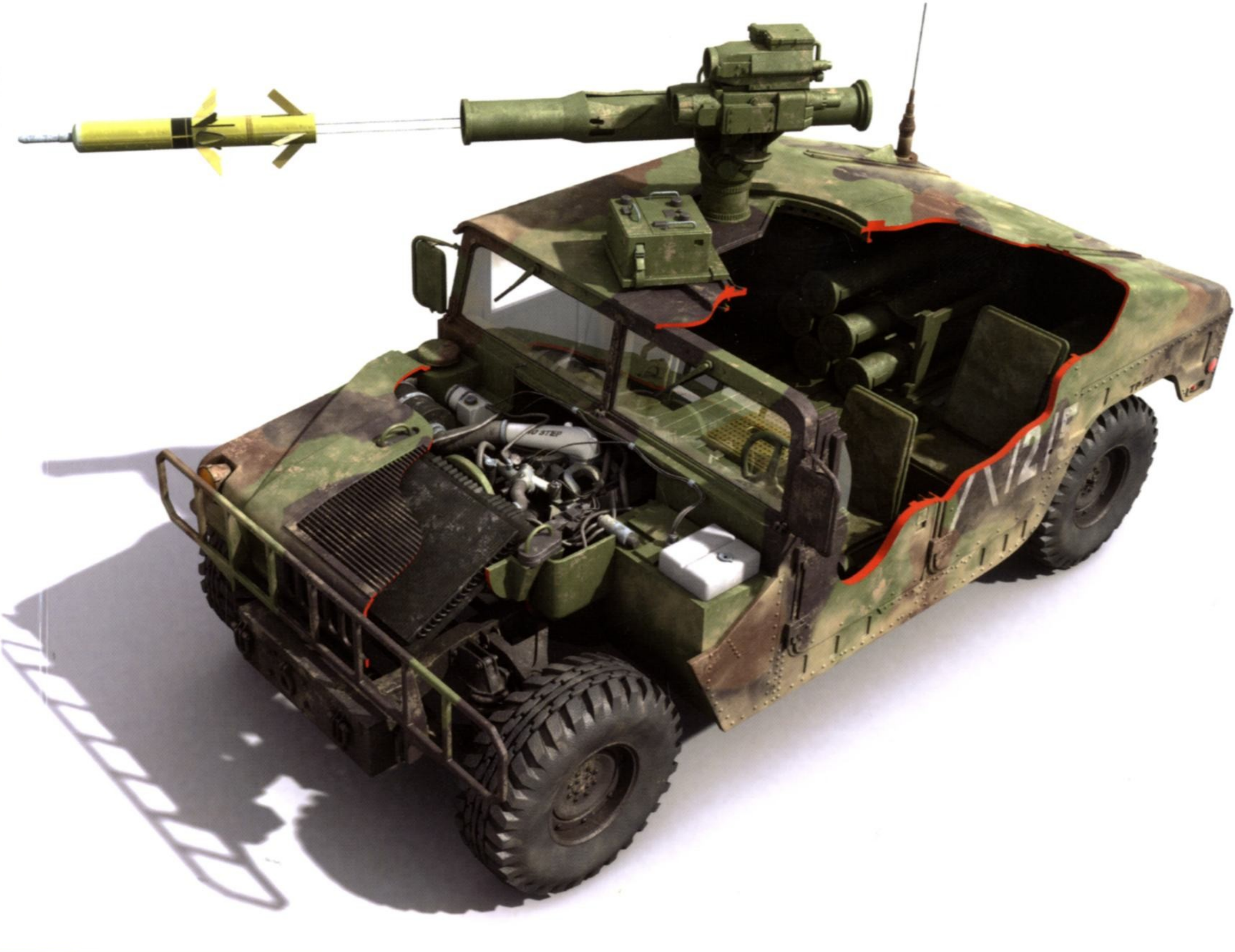
HMMWV Humvee 1980–2005

US Army tactical vehicle



Steven J Zaloga • Illustrated by Hugh Johnson

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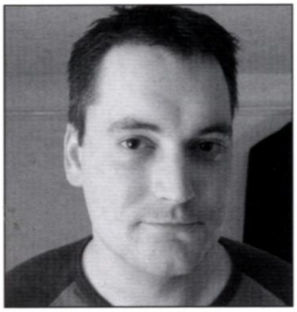

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CONTENTS

INTRODUCTION 3

HMMWV ORIGINS 3

FIRST-GENERATION HMMWV 8

INTO COMBAT 11

HMMWV VARIANTS 14

- Missile HMMWV: The Avenger
- Scout HMMWV
- Heavy HMMWV Variant (HHV)
- Green HMMWV

UP-ARMORED HMMWVS: FIRST STEPS 21

THE NEW CHALLENGE: OPERATION *IRAQI FREEDOM* 22

HARDENING THE HMMWV 33

NEW PROBLEMS: EXOTIC SOLUTIONS 36

21ST-CENTURY HMMWV 37

INTERNATIONAL HMMWV 39

MISSILE HMMWVS 41

ELECTRONIC HMMWVS 43

FURTHER READING 44

COLOR PLATE COMMENTARY 45

INDEX 48

Sandini

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Editor's note

The measurement of 'tonne' throughout the text refers to a metric ton, equivalent to 1,000kg.

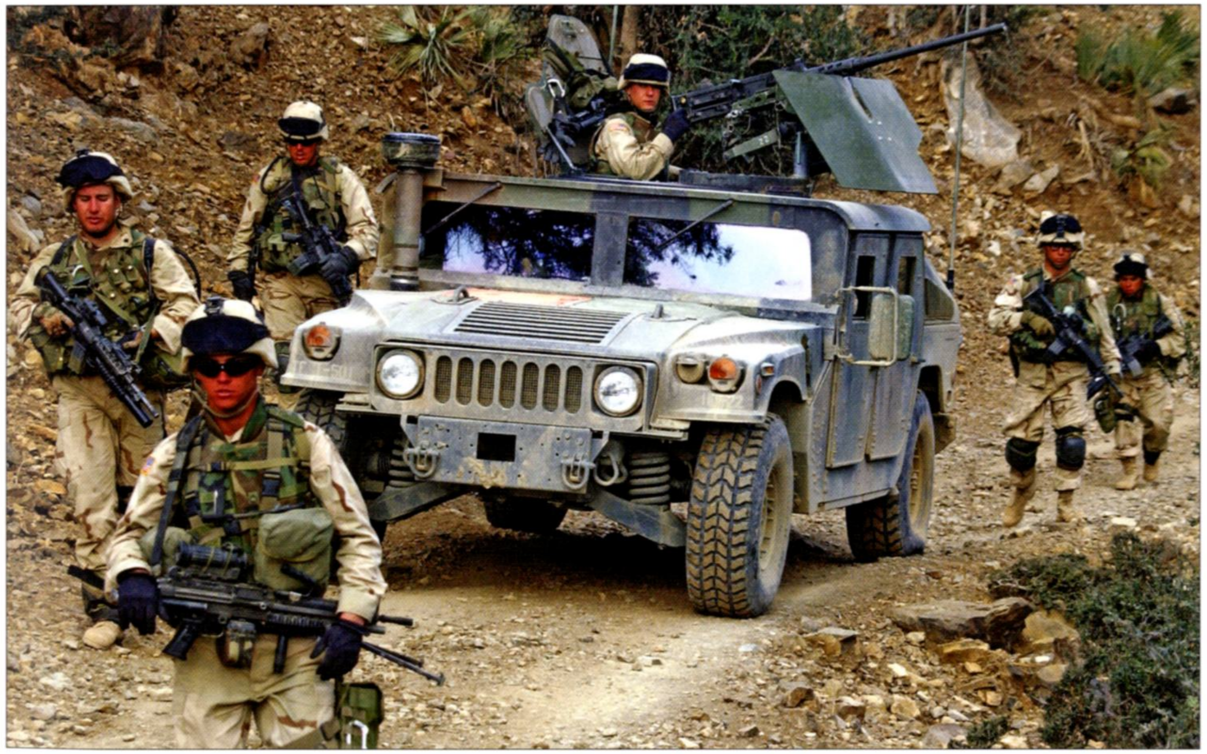
HMMWV HUMVEE 1980–2005 US ARMY TACTICAL VEHICLE

INTRODUCTION

The HMMWV, better known as the Humvee or Hummer, is the most influential military tactical vehicle of the current generation. Like its forebear, the jeep, the Humvee has proven to be a practical blend of mobility, load-carrying capacity, and durability. It has been built in a bewildering variety of versions, with more appearing every year, and over 175,000 had been manufactured by 2005. The Humvee has spawned a host of imitators around the globe, and has migrated into the world of civilian automobiles with the civilian Hummer and Hummer H2 vehicles.

HMMWV ORIGINS

HMMWV is an abbreviation of High Mobility Multipurpose Wheeled Vehicle, the title in keeping with the US Army's tradition of adopting awkward, tongue-twisting names for its materiel. The origins of the HMMWV are as convoluted as its name.



Paratroopers of the 1/501st Infantry are accompanied by an M1114 up-armored HMMWV as part of a patrol to capture Al Qaeda fighters during Operation *Avalanche* in Afghanistan in February 2004. This M1114 UAH is fitted with a standard armored gun shield for the .50-cal. heavy machine gun. (Spc Gul Alisan, US Army)

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In the wake of the Vietnam War, the US Army's tactical vehicle pool was in an unhappy state. The Army had adopted a new generation of high-tech light tactical vehicles in the 1960s, including the M151 Mutt (Military Utility Tactical Truck) ¼-ton 4×4 truck and the M561 Gama Goat 1½-ton 6×6, both of which were plagued by innovations that were more attractive on paper than in real-life conditions. The M151 was the descendent of the wartime jeep and its postwar replacement, the M38 ¼-ton truck, but sadly it did not live up to the great tradition. The M151 had a lightweight independent suspension system that was prone to oversteering and roll-overs when turning too quickly. Although changes were made to the suspension, the M151 was widely regarded as a flawed design.

The Gama Goat used an innovative articulated powertrain for the independent rear cargo compartment, and a center-mounted engine. It proved to be a mechanical nightmare in use, however, with a dismal durability record and an engine so loud that drivers were obliged to wear ear protection. The less ambitious M715 1¼-ton truck adopted in 1966 was far more conventional than its stablemates, but was plagued by engine problems. Added to these problems, the vehicle fleet had suffered from heavy use during the Vietnam War period, and many vehicles were reaching the end of their planned lifespan.

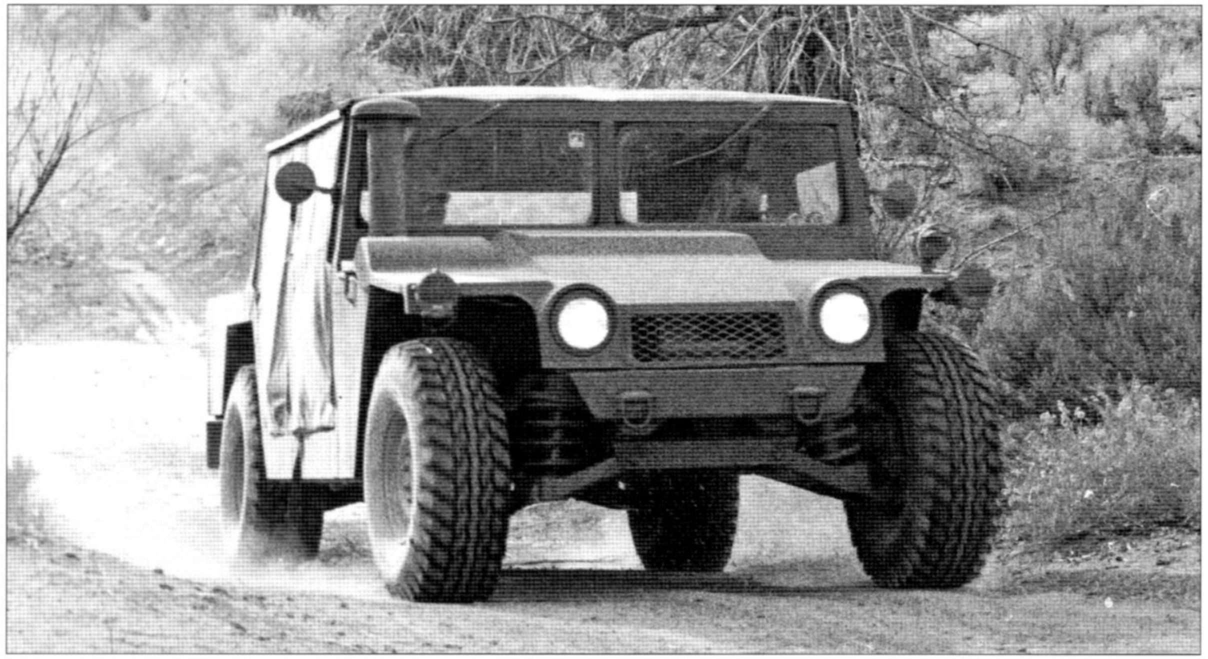
In the mid-1970s, the Army began to consider its options. To begin with, many Army officers felt that there were simply too many vehicle types in the light tactical vehicle fleet – a bewildering mixture of off-the-shelf commercial designs and tactical machines in several overlapping payload classes. An Army study in 1972–73 concluded that 400,000 of the Army's 600,000 vehicles could be replaced by low-cost commercial vehicles for roles that did not require cross-country mobility. Many Army vehicles were simply used around post for transportation and light load carrying, so there was no real need for an expensive all-terrain vehicle. This insight led to a program to adopt commercial Dodge pick-up trucks as the M880 ¾-ton truck, to be a low-cost option for non-tactical light truck requirements.

With the M880 program in mind, the Army began to examine a variety of commercial cross-country vehicles to see if any would suffice as a replacement for the M151. Several 4×4 vehicles were tested at Fort Hood in 1975–76, including the Jeep CJ-5, the Chevrolet Blazer, Dodge Ramcharger, and Ford Bronco. These vehicles did not entirely satisfy Army needs, and the issue of an M151 replacement was put in abeyance until the defense budget increased. (In the wake of the Vietnam War, the late 1970s was a period of defense spending cut-backs and so older vehicles were kept in service beyond their intended life expectancy.)

In the hunt for a new vehicle, one requirement stood out from the rest. In the early 1970s, the Army had introduced the new Tube-launched, Optically tracked, Wire-guided (TOW) antitank missile. It was mounted on both tracked and wheeled vehicles, including a variant of the M113 armored personnel carrier and the M151 Mutt. It soon became evident, however, that the M151 was far from ideal as a TOW carrier since the combination of the launcher, batteries, and spare missiles overwhelmed such a small vehicle. There was no other all-terrain light tactical vehicle immediately available as a TOW carrier, so in the mid-1970s, the Army began to look around for a dedicated cross-country vehicle. The studies examined light armored cars such as the Cadillac Gage Scout, and also "dune-buggy" type unarmored wheeled vehicles. As a result of these studies, the Army formulated a requirement for the Combat Support Vehicle (CSV) to handle the TOW mission. The US Congress was not happy about the idea of developing a new vehicle for such a small production run numbering only 3,800, and terminated the program in 1977. Although not obvious at the time, the CSV was the first glimmer of the HMMWV program.

In the face of Congressional opposition, the Army went back to the drawing board and reoriented the program. It now aimed to replace a broader range of light tactical vehicles, from the Mutt to the Gama Goat, with a new XM966 High Mobility Weapons Carrier (HMWC). While this was a major improvement in the eyes of Congress, it was still not comprehensive enough, and funding was again cut in the 1979 budget. Both Congress and the Department of Defense were interested in consolidating not only the Army's light tactical truck requirements, but those of the Marine Corps and Air Force as well. As a result, the XM966 was restructured and resubmitted to Congress in 1980. This time the program received Congressional backing, and proceeded under a new name as the High Mobility Multipurpose Wheeled Vehicle (HMMWV). Instead of the 3,800 vehicles proposed under the CSV program, HMMWV was aimed at fielding 50,000 vehicles that would replace all tactical vehicles in the quarter-ton to ton-and-a-quarter range and would encompass Army, Marine, and Air Force needs.

The HMMWV was an interesting departure from the long-standing jeep tradition dating back to World War II. Since 1941, the Army had generally adopted two vehicles for the light tactical role: a ¼-ton (0.22-tonne) jeep for basic utility roles, and a ¾-ton (0.7-tonne) truck for more demanding roles. The HMMWV ended this dual-track approach, adopting a single vehicle to cover the entire range of



This is the original pilot model of the AM General XM966, seen on a test track before the Army trials. (AM General)

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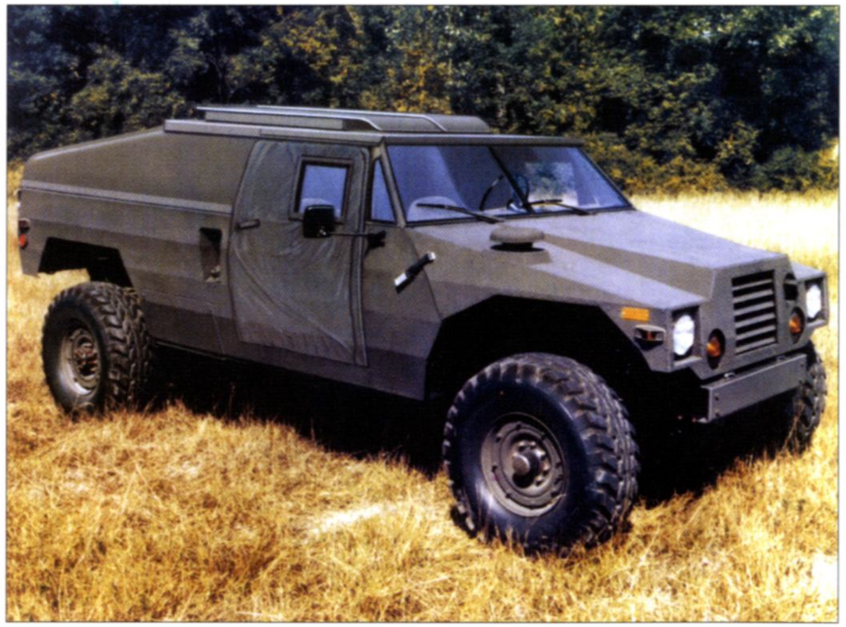
missions. This was in part due to the recognition that the jeep had continued to grow larger over the years from a ¼-ton (0.22-tonne) capacity to a ½-ton (0.45-tonne) capacity, and the TOW mission suggested that more growth would be needed.

The Army released a letter-of-interest to industry in July 1980 outlining its basic requirements. The HMMWV was intended to be a modular design that could serve as a general-purpose tactical utility vehicle, a prime mover, a carrier for specialized equipment, an ambulance, and a weapons carrier. It was intended to replace the Marine Corps' M274 Mule, and the Army's M561 Gama Goat family, M792 ambulance, and M151 Mutt. Sketches released to industry at the time showed a basic utility truck, a personnel transporter, an ambulance, a forward observer vehicle, a weapons carrier, and a communications vehicle with a rear-mounted shelter. The HMMWV also marked a shift towards diesel engines.

Congress was interested in fostering competition in the program to ensure that a variety of technical approaches were examined, so in 1981 three of the bidders were given development contracts: Chrysler Defense, AM General, and Teledyne Continental. The early 1980s were a time of considerable turmoil in the American automobile industry due to the onslaught of excellent Japanese vehicles, and there was considerable consolidation and regrouping as American auto companies attempted to compete. Chrysler Defense was the shortest-lived of the three bidders, as General Dynamics Land Systems (GDLS) purchased it in the midst of the competition. The Jeep brand at the time was owned by AM General's parent company, American Motors, which had purchased Kaiser-Jeep in 1969. The Ford-designed M151 Mutt had broken the tradition of Army jeeps from the original World War II design through the M38, and AM General was determined to win it back. This attempt soon became a moot point, as in 1982 American Motors' financial troubles forced it to sell off AM General, with the new owner being LTV Aerospace and Defense.

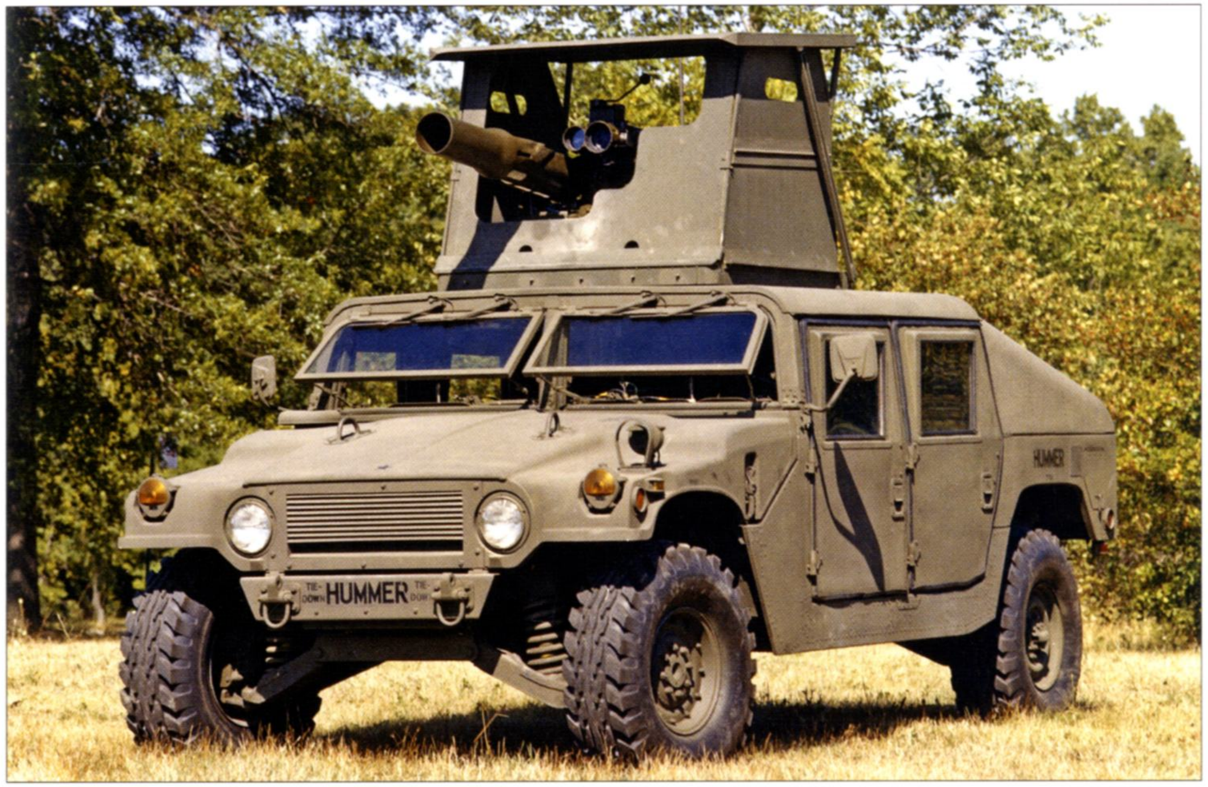


This was the General Dynamics proposal for the armament carrier in the XM966 competition, one of three designs competing for the HMMWV contract. (GDLS)

All three firms had already begun to design a new tactical vehicle, some connected with earlier Army programs such as the CSV, and others in anticipation of an Army contract. Teledyne had participated in the earlier CSV competition, but was obliged to completely refashion its rear-engined XR311 Cheetah design to make it more suitable for the utility role. GDLS inherited Chrysler's Expanded Mobility Truck (EMT) design and configured it to the HMMWV requirement. AM General had already begun work on a new tactical truck design in July 1979 using company funds in hopes of regaining the Army market. The AM General prototype was named the "Hummer," a more felicitous choice than HMMWV, and the company registered it as a brand name, suspecting that the HMMWV would have commercial possibilities.

Deliveries of prototypes from the three manufacturers began in early 1982. The formal trials began in July 1982 at the automotive test tracks at Aberdeen Proving Ground (APG), Maryland, supplemented by the desert tracks in Yuma, Arizona. As expected, the rigorous trials uncovered numerous engineering problems, so the contenders delivered a second batch of modified prototypes to Fort Hunter-Liggett in California in September 1982 for the Phase 2 tests, with soldiers serving as the test drivers. Phase 3 started at the end of 1982, aimed at testing specific features such as rough-terrain handling, deep wading, and other tactical requirements.

During the trials, the AM General Hummer came out on top, being lighter than the competition and displaying excellent durability. A variety of problems were uncovered during the tests, but they were not especially worrisome. The General Motors DDA V8 diesel engine, a



The initial production batch of AM General HMMWVs for the Army tests had a number of differences from the series production versions, such as the slat grille seen here. This TOW carrier also displays the planned Kevlar parapet around the missile launcher, a feature that was subsequently dropped during series production. (AM General)

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INITIAL HMMWV PROCUREMENT FUNDING PLAN

Year	$ (millions)	Vehicles
1983	59.3	2,693
1984	178.7	9,655
1985	298.0	15,476
1986	339.2	18,809
1987	308.9	8,340
Total	$1,184.1	54,973

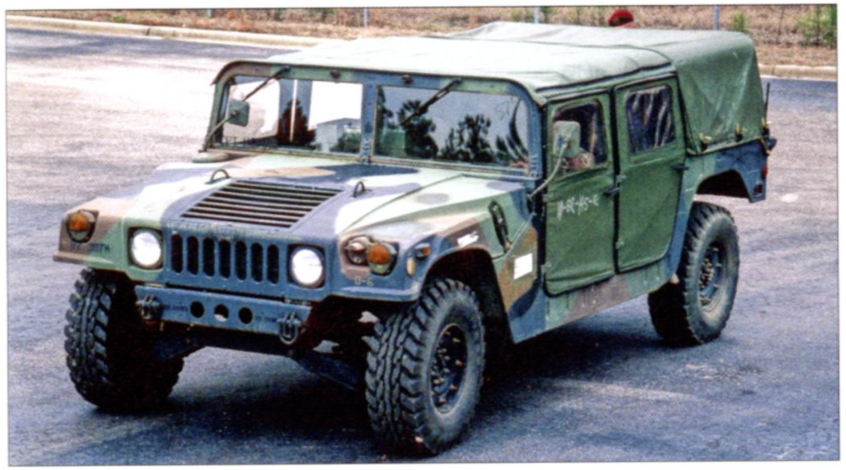
standard commercial design, had a handful of failures that the Army testers assessed to be normal random occurrences rather than systematic problems. The lighting system suffered a number of failures due to vibration, so the lights were relocated and further insulated from shock. There were structural weld problems mainly in the weapons carrier loader door, which led to design changes. Problems with the aluminum hub castings and suspension arms forced a switch to cast iron. Difficulties during the fording trials led to changes in sealing in the powertrain and vehicle instruments. All of these changes were made before the start of series production. There were some cosmetic changes during the development as well. The original horizontal slatted grille of the prototypes eventually gave way to a vertical grille reminiscent of the legendary wartime jeep.

The first Army contract was awarded on March 22, 1983, for the first batch of vehicles funded in Fiscal Year 1983. This was the first option on a five-year multi-year contract for HMMWVs for the Army, Air Force, and Marine Corps. The Army was the principal user of the HMMWV, with the Marine Corps acquiring 11,000 from the original contract and the Air Force a further 1,100. The baseline utility/cargo vehicle was priced at $20,410, while the weapons carrier was $28,382. Although the HMMWV was substantially more expensive than the M151 Mutt, the Army worked around this problem by purchasing a mix of off-the-shelf commercial trucks for rear-area use, and the HMMWV for all-terrain tactical employment. The low end of the mix was the Chevy Blazer, selected in the early 1980s to meet the M1008/M1009 Commercial Utility Cargo Vehicle (CUCV) requirement. The CUCV was deployed in logistics and support roles where the more expensive HMMWV was not really needed, and about 70,000 were purchased in 1983–87 in several different configurations. Both the HMMWV and CUCV shared a common engine design.

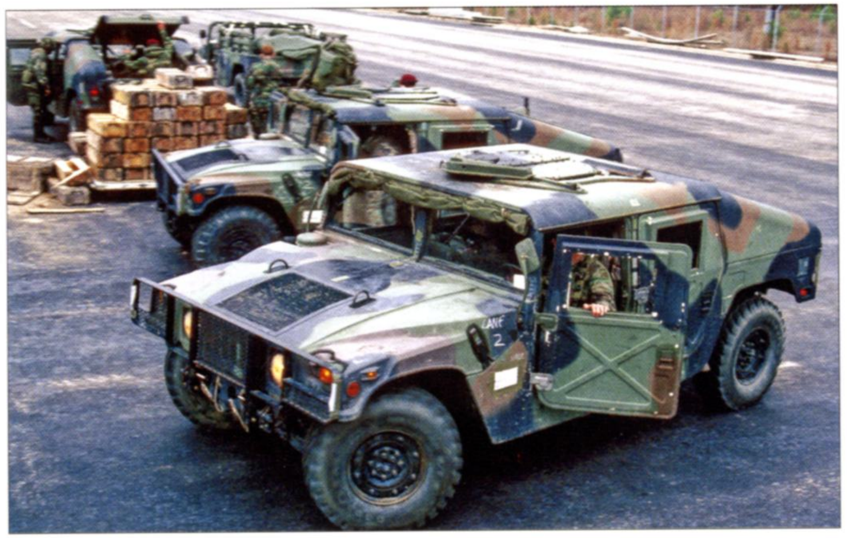
FIRST-GENERATION HMMWV

Production of the first HMMWV took place in April 1984 at AM General's plant in Mishawaka, Indiana, and the first vehicles were sent for initial product testing to certify that they met the contract requirements. Once this testing was completed, the first HMMWV trucks were issued to units in October 1985. The initial contract batch was called Group I and encompassed five basic types in three basic families. The baseline vehicles were the M998 and M1038 troop/cargo carriers. The basic difference between the M998 and M1038 was that the M1038 was fitted with a winch while the M998 was not. The winch was located in the front of the vehicle and was mainly intended for self-extraction if the vehicle became bogged in soft soil. The M998 was originally produced in two types, with a two-door and a four-door cab, while the M1038 came in three principal types including two-door cab with rear troop seats, two-door cab with rear cargo configuration, and four-door cab with rear cargo. All of these vehicles employed some form of soft-top cab – that is, a canvas top. The top was removable and so it was common to see these types of HMMWV without a top cover.

The M966 TOW carrier, as its name implies, was designed specifically for the TOW antitank missile. It was a hard-top configuration with the M220 launcher for the TOW mounted on a skate ring on the roof. The rear cargo area was configured with racks to carry six additional TOW missiles. The angled back roof was designed to protect the stowed missiles both from the weather as well as from the back-blast of the missile when launched. A TOW carrier version with a winch, the M1036, was also acquired. The original version of the TOW carrier submitted to the Army employed a Kevlar light armor shield around the launcher. This concept was discarded and the TOW launcher in service was simply fitted to the vehicle skate ring.



The basic M998 cargo/troop carrier came in several configurations, including this soft-top, four-door version seen here with the 82d Airborne Division in 1992. The related M1038 is essentially the same except for a winch mounted in the front under the radiator. (Author)



The Army's M1025 armament carrier, like the example seen here from the 82d Airborne Division, can be distinguished from the similar Marine M1043 by the door design. The M1025 with basic armor has the characteristic "X"-pattern door while the Marine M1043 with the heavier "supplemental" armor has a flat door. (Author)

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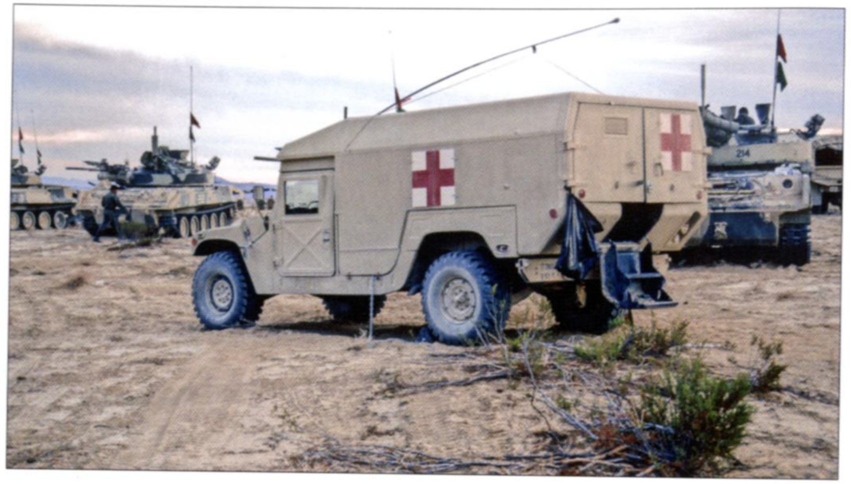
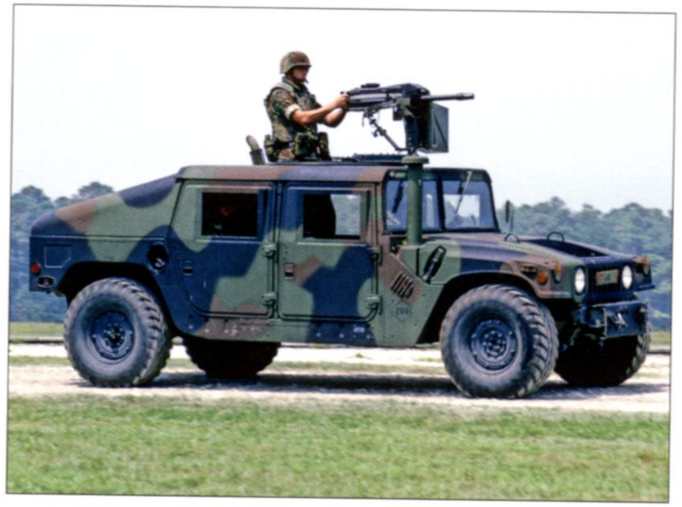


The M996 mini-ambulance, as seen here at the US Army National Training Center in 1990, is a two-litter design, while the M997 with a higher shelter is a four-litter ambulance. (Author)

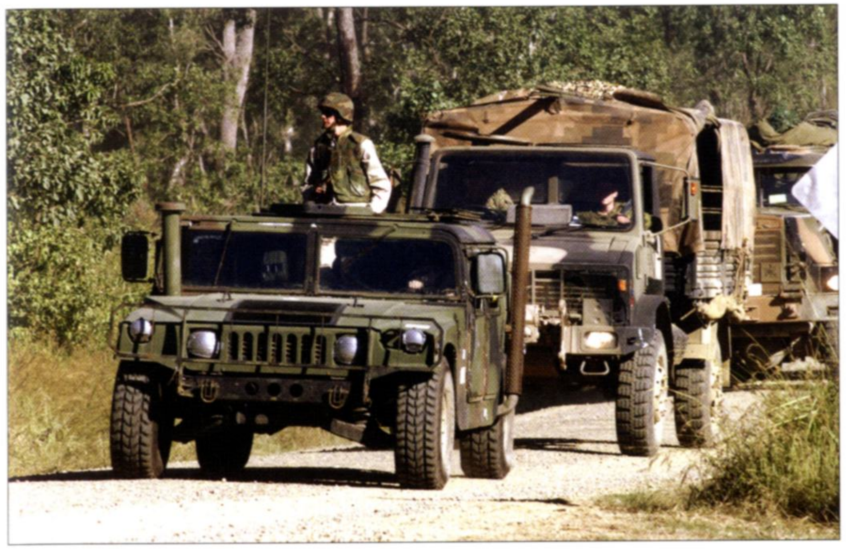
The final family in Group I was the M1025/M1026 armament carriers. These were configured, like the M966, with a hard top and a skate ring that could accommodate a variety of weapons, including the M60 7.62mm machine gun, .50-cal. machine gun, or 40mm Mk 19 grenade launcher. The difference between the M1025 and M1026 was that the M1026 had a winch. It is very difficult visually to distinguish this family of HMMWVs from the TOW carrier versions unless the weapon is actually in place on the ring. The basic HMMWVs had no armor at all, but armament carriers and the hard-shell ambulances had a limited armor package called "basic armor," which used steel, Kevlar, and polycarbonate window material to provide modest protection against spent bullets and fragments equivalent to a 17-grain fragment traveling at 1,394ft/sec (425m/s).

The Group II vehicles were designed to accommodate different types of shelters in the rear bed and development took place after the basic tactical vehicles of Group I. Manufacture of Group II vehicles began in 1987, initial product testing was completed in February 1988, and they were first fielded in April 1988. The M1037/M1042 shelter carrier was designed to carry the standard S-250 shelter in the rear bed, which was used for a variety of applications, especially for carrying tactical radio and other electronics teams. The designation difference was, as usual, due to the winch (M1042) or no winch (M1037) configurations. The other members of Group II were two ambulances, the M996 two-litter "mini-ambulance," and the M997 four-litter "maxi-ambulance."



This M1043 armament carrier at Camp Lejeune in 1998 shows the characteristic flat armored door panels on the Marine versions. This particular example is armed with a Mk 19 40mm grenade launcher, a common weapon fit on the HMMWV with both the Army and Marines. (Author)

Apart from the Army variants, the US Marine Corps established some of its own requirements. The most significant of these was the decision to acquire vehicles with "supplemental armor," which included polycarbonate windows and steel-reinforced doors. The supplemental armor was not able to withstand close-quarter fire, but was intended to protect the crew from shrapnel and long-range small-arms fire and could stop fragments equivalent to a 44-grain fragment traveling at 2,132ft/sec (650m/s). There were three families of the Marine HMMWVs: the M1045 and M1046 (with winch) TOW carrier, the M1043 and M1044 (with winch) armament carrier, and the M1035 two-litter ambulance.

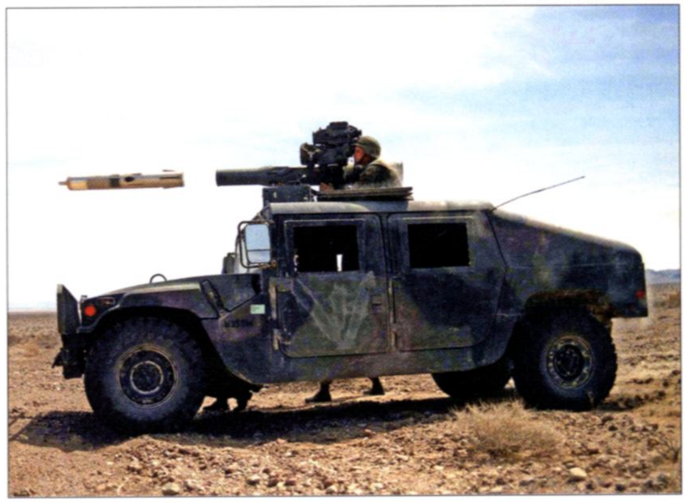


Another distinguishing feature of the Marine HMMWVs compared to the Army types was the use of an extended exhaust to permit wading ashore from landing craft. This feature is evident on the rear side of this M1043 armament carrier leading an Australian Army column in the Shoalwater Bay Training Area during the joint Exercise Tandem Thrust in May 2001. (Sgt John Giles, US Marine Corps)

The HMMWV proved so successful when introduced into service that in August 1989 the original contract was extended by a further 33,331 vehicles for the Army and Marines, increasing the US procurement objective to 88,304 HMMWVs. This total would continue to increase over the years as the HMMWV's versatility became more evident.

INTO COMBAT

The first combat use of the HMMWV was during Operation *Just Cause*, the US military operation in Panama on December 20, 1989. The 2/504th Parachute Infantry parachuted into Panama and was followed by the rest of the 82d Airborne Division and other US Army units. There was some brief but bitter urban fighting between US troops and Manuel Noriega's paramilitary units in Panama City and El Chorillo. HMMWVs were in service with several of the US units by this time, and were used in some of the street actions. In general, the Army was quite pleased with the HMMWV's performance; although it had not been intended for use in close combat, paratroopers and light infantry units used it in this role with some success. Following the fighting, in its after-action report the 6th Infantry Regiment noted the need for sandbags or some other form of protection when light tactical vehicles were used in



This photo of an M1045 TOW carrier of the 3/2d Marines at Twenty-nine Palms, California, in April 1997 shows the TOW missile a fraction of a second after leaving the M220 launcher. The Marine M1045 can be distinguished from the comparable Army M966 by the plain side doors, which are fitted with supplemental armor compared to the X-patterned doors of the Army versions. (Lance Cpl E.J. Young, US Marine Corps)

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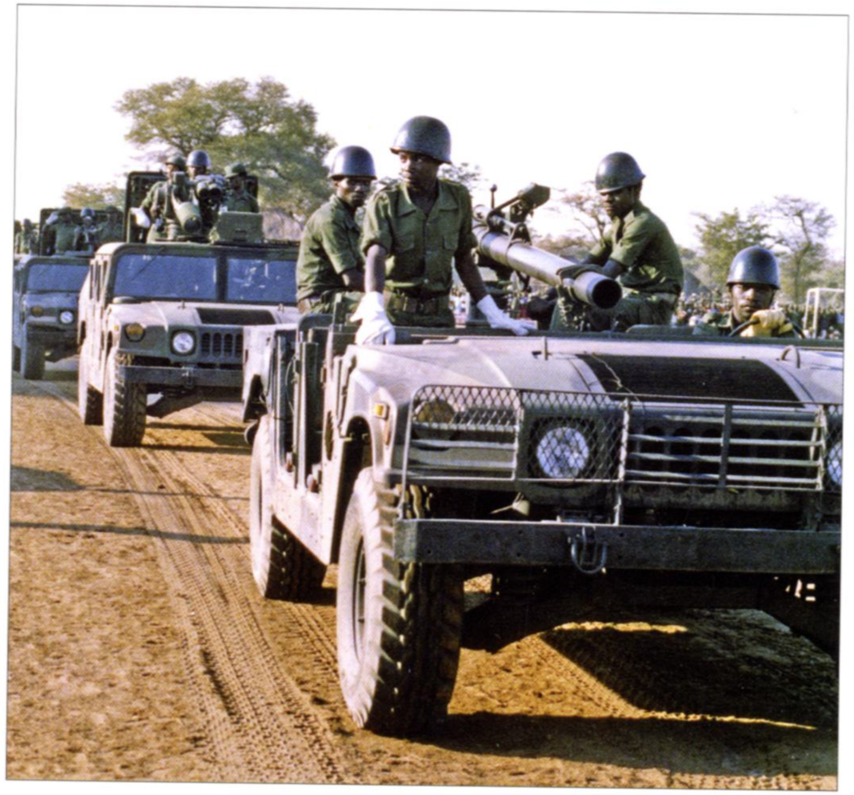
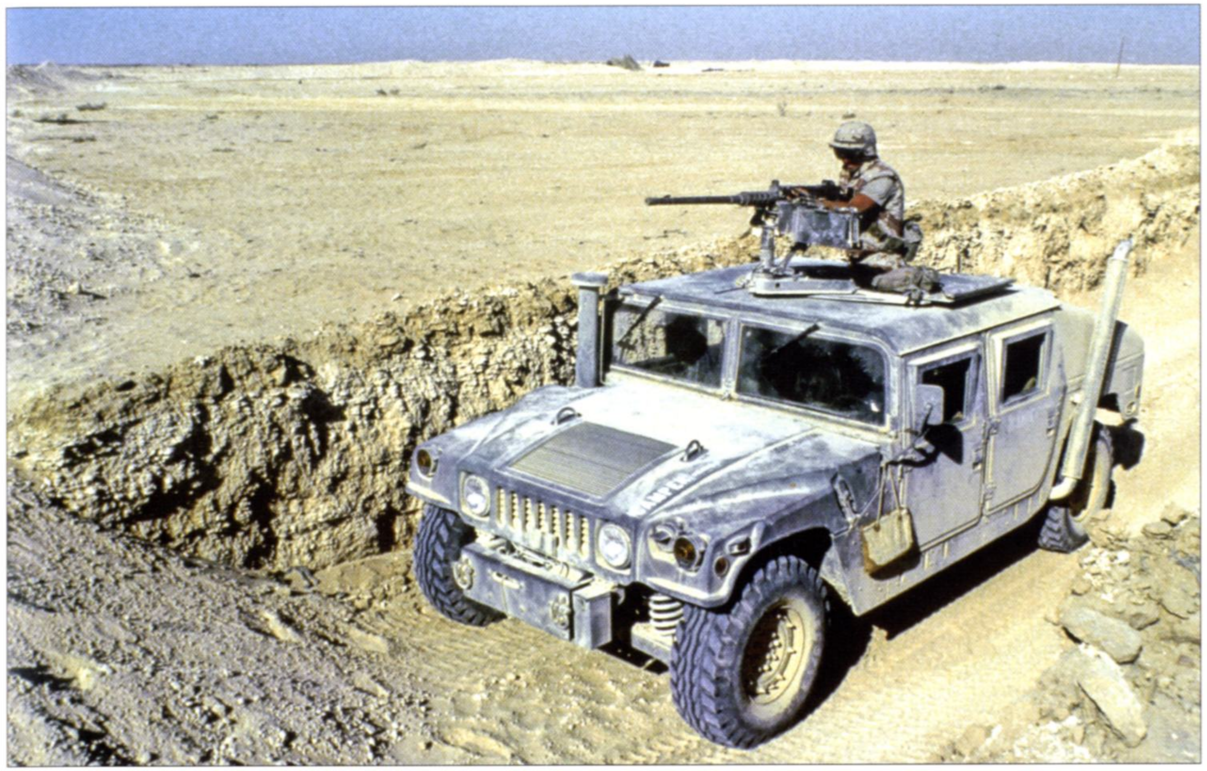
close-combat roles. It also recommended the addition of an armored parapet around the roof armament station akin to the Armored Cavalry Assault Vehicle (ACAV) kits used on M113 armored personnel carriers in Vietnam. The 6th Infantry preferred the use of the .50-cal. heavy machine gun in urban fighting since it was more versatile than the TOW missile when there were no enemy armored vehicles present.

While the HMMWV was in action in Central America, there was a more obscure use of HMMWVs in western Africa. In December 1989, Angola's Soviet-backed government army, the People's Armed Forces for the Liberation of Angola (FAPLA), launched a massive attack on the rebel Union for the Total Independence of Angola (UNITA) of Dr Jonas Savimbi. Operation *Final Assault* managed to penetrate deep into UNITA-held territory in southeastern Angola, but in the decisive battle of Mavinga in February 1980, the FAPLA mechanized forces were routed by the lighter UNITA units, losing 91 tanks, 240 light armored vehicles, and over a thousand troops. A key element of the UNITA tactics was the use of highly mobile *cassador* (hunter) battalions riding cross-country vehicles such as Toyota Land Cruisers. These "gun buggies" were armed with a wide range of weapons, including Soviet 14.5mm ZPU-1 antiaircraft heavy machine guns, US 106mm recoilless rifles, and other types of crew-served weapons. When UNITA staged its victory parade in Jamaba later in the year, some of the *cassador* battalions were equipped with small numbers of HMMWVs, mostly the basic M998. The origins of these rebel HMMWVs is a bit of a puzzle since officially the HMMWV had not yet been exported to any country in Africa. In all likelihood, the HMMWVs were provided to UNITA as part of clandestine US aid handled by the CIA.



The first combat deployment of HMMWVs by forces other than those of the United States was as "gun buggies" by the UNITA *cassador* mobile battalions during the fighting with the FAPLA in Angola in 1989–90. The lead HMMWV here is equipped with a US 106mm recoilless rifle. (Free Angola Information Service)



A Marine Corps M1043 armament carrier is seen taking shelter during Operation *Desert Storm* in February 1991. The Marine HMMWVs can be distinguished by the flat door panels as well as the deep-wading extension to the exhaust seen near the rear wheel. (USMC)

The HMMWV came to public attention in Operation *Desert Storm* in 1991. By the time that US forces were deployed into the Persian Gulf in the fall of 1990 as part of Operation *Desert Shield*, the HMMWV had become an integral part of both the Army and Marine Corps, with 59,883 HMMWVs in Army service and about a quarter of that number in Marine service. The Army deployed over 20,000 HMMWVs to the theater prior to the launch of Operation *Desert Storm*. Besides the HMMWV, some units still had older types such as the M151 Mutt, M561 Gama Goat, and M880 truck, as well as the newer M1008 CUCV. A total of 13,291 CUCVs out of the Army's inventory of 58,604 were deployed to the theater, although their use was generally limited.

The HMMWV proved to be "the light vehicle of choice" during the lightning war against Iraq. It had operational readiness rates of over 90 percent, and the troops found that it could go almost anywhere a tracked vehicle could go. The only complaint from troops was that the seating was too hard, particularly when used in prolonged cross-country travel. Besides the basic troop carriers and armament carriers, there were numerous types of specialized HMMWVs in use during *Desert Storm*, including the Trojan Spirit satellite communications system. The HMMWV became an icon of the war, a contemporary counterpart of the World War II jeep in the public imagination. Although it was not widely known outside the military prior to *Desert Storm*, the HMMWV became familiar to the public on television newscasts and in the print media.

The CUCV proved adequate for limited roles, but was not suited to extensive off-road travel in rough terrain. A postwar report on the performance of the M151, Gama Goat, and M880 noted that they "did not perform well" and so all were scheduled to be removed from Army

Sandini

service in 1993. The HMMWV was also used by other services in the war, for example by the Air Force for airfield security missions.

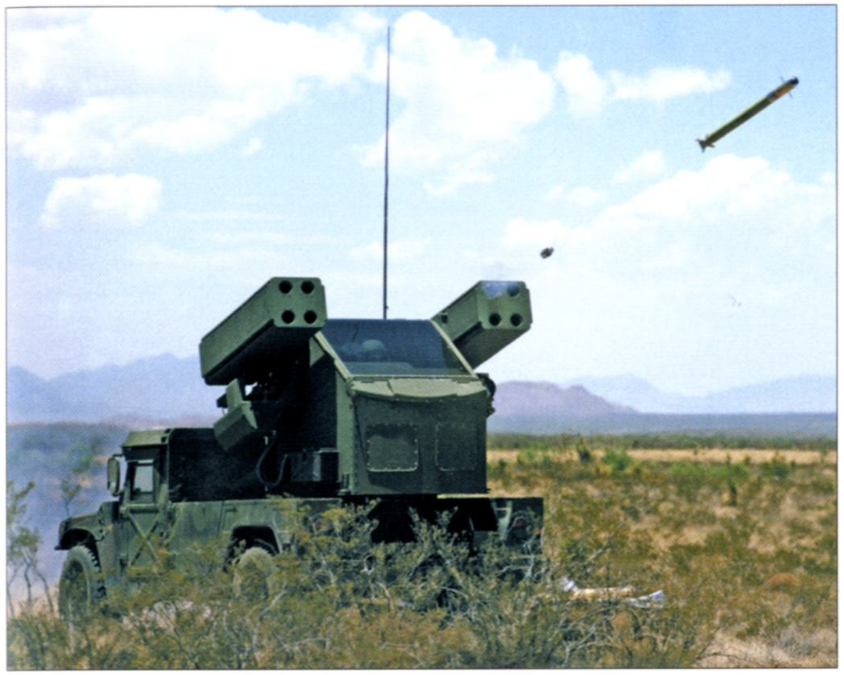
A curious spin-off from the war was the birth of the civilian Hummer. The first civilian customer for the HMMWV was the popular actor, and later governor of California, Arnold Schwarzenegger. After seeing HMMWVs on television during the war, Schwarzenegger was determined to get his own Humvee as the ultimate "muscle car." AM General at first turned down his request, since the vehicle was not equipped with environmental controls and other government-mandated features. Schwarzenegger was persistent and money was no object. AM General eventually recognized the publicity potential, and also began to realize that a genuine civilian market for such a vehicle might exist, even if the vehicle was a bit expensive compared to civilian SUVs (sport utility vehicles). Schwarzenegger got his HMMWV, and towards the end of 1992 AM General began manufacturing a small but growing number of civilian Hummers. This output later led to a marketing agreement with General Motors, which took over the civilian aspects of the program, including a new, smaller civilian derivative of the HMMWV, the Hummer H2.

Although the focus of this book is the military HMMWV, it is worth noting that the civilian Hummer had some repercussions on the military models. The civilian customers were somewhat more demanding than the military customers in terms of operator features, for instance seating, as well as some technical features such as engine options. More importantly, they were willing to pay a premium price for the added features. As is mentioned below, some of the features originally designed to satisfy civilian customers later migrated to later versions of the military HMMWV.

HMMWV VARIANTS

Missile HMMWV: The Avenger

Although not part of the Army's initial truck program, in the mid-1980s the HMMWV emerged as the prime candidate for a new air defense missile carrier as part of the Forward Area Air Defense (FAAD) program. The idea was to place a launcher for the FIM-92 Stinger man-portable missile on a mobile platform to provide mobility and the capacity to include radios to link the missile operator into the air defense alert network. The US Army Missile Command in Huntsville, Alabama, came up with a pedestal launcher configuration that paired the Stinger with 2.75in unguided rockets. However, the Army instead decided to shift the development of the Pedestal Mounted Stinger (PMS) to industry, and Boeing Corp. won the development contract with its Avenger design. The PMS Avenger is mounted on the M973 HMMWV and consists of a turreted launch system with eight Stinger missiles in two pods on either side of the turret. The main missile armament is supplemented by a single .50-cal. M3P machine gun located under the right pod with 200 rounds of ammunition, which provides the vehicle with some self-defense capability but can also be used against some slow-moving air targets such as helicopters. The missile operator sits below a transparent weather cover and is alerted to the approach of hostile aircraft or helicopters over the vehicle radio from forward alert radars in the air defense unit. The target is acquired using an optical sight in daylight or an AN/VLR-1 thermal imaging sight in the dark. Both optical sights are linked to an automatic video tracker, and target ranging is provided by a CO2 laser range-finder to avoid wastage of missiles. The first Avenger was delivered to the US Army in November 1988 and the first PMS battery was activated in April 1989. By the time production ended in December 1997, the US Army had acquired 767 Avengers while the Marines obtained 237.



The most successful of the missile HMMWVs has proven to be the PMS Avenger, a combination of the highly successful FIM-92 Stinger short-range air defense missile and the equally successful HMMWV. Each of the pods on either side of the operator's cabin contains four missiles. (Raytheon)

Scout HMMWV

There was some controversy among US Army tacticians in the late 1980s regarding the best equipment for reconnaissance units. The Army had already obtained the M3 Cavalry Fighting Vehicle for this mission, but some officers felt that a smaller and less conspicuous vehicle such as the HMMWV would be more suitable. As a result, during Operation *Desert Storm* some scout units operated HMMWVs while the rest remained with the M3 CFV. These were standard HMMWVs, not customized for the scout role. Following the war, the consensus was that the unarmored HMMWV was not ideal as a scout. In some cases, HMMWV scout units would be out front on their mission, but once contact was made, divisional artillery was reluctant to engage since the HMMWVs offered their crews no protection. As a result, the Army drew up a requirement for an up-armored battalion scout vehicle based on the HMMWV that eventually led to the M1109 UAH. As mentioned below, the M1109 was never procured in its intended scout role, but instead the Army ordered small numbers for use by military police units. This was not the end of the scout debate, and in 1994, the idea emerged to create a Scout Platoon Modification kit. The kit was intended to be added to the M1109 or equivalent UAH, and to include equipment important in the scout role, such as an AN/UAS-11 or -12 thermal imaging sight, two SINCGARS radios, a GPS navigation system, a new alternator to power the added equipment, and improved cargo and stowage racks.

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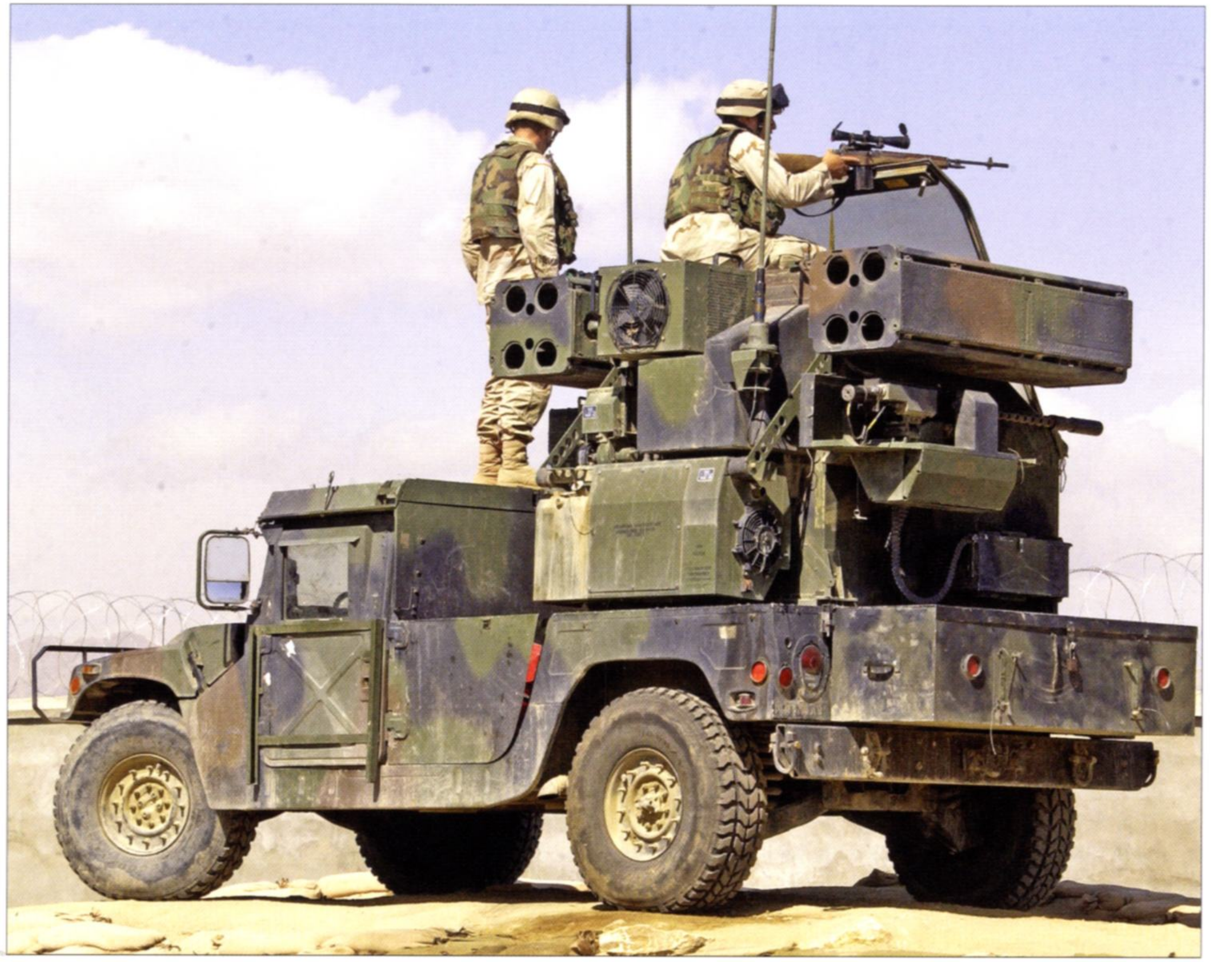
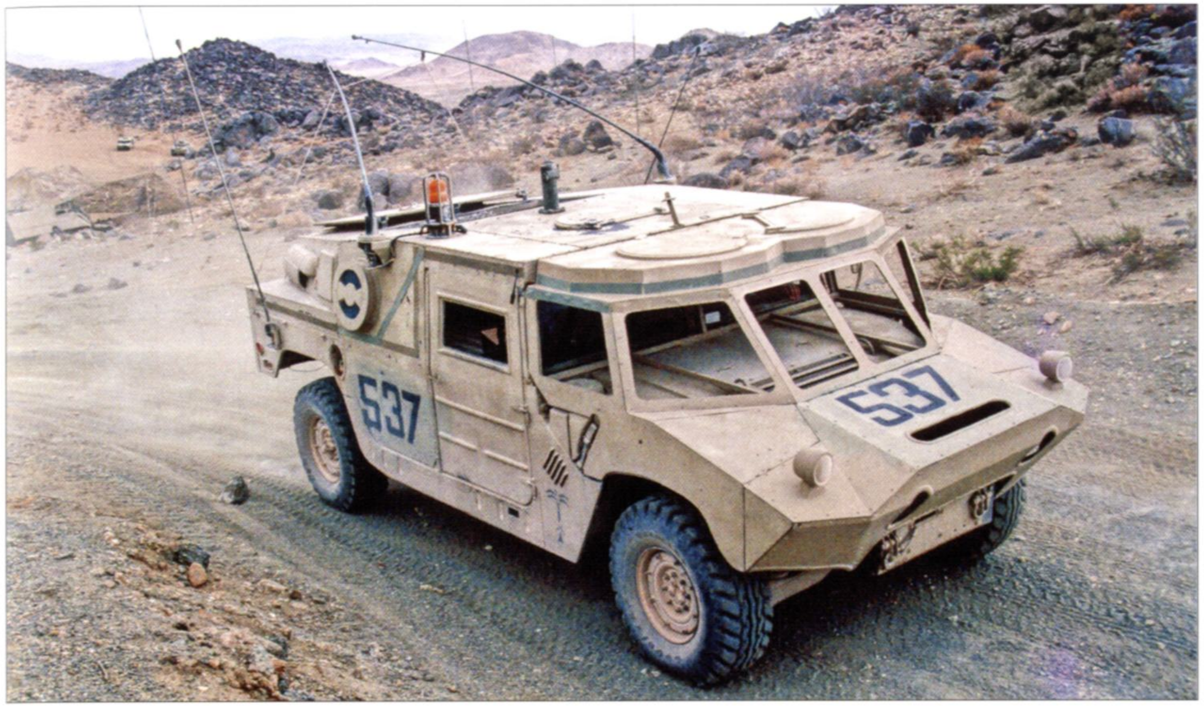


The crew of a PMS Avenger of Battery B, 3/62d Air Defense Artillery maintain a security checkpoint near Ghazni, Afghanistan, in March 2004. The Avenger has proven popular in peacekeeping operations, in spite of the lack of enemy aircraft threats, since its thermal imaging sight is very effective for surveillance day or night at long range. (Sgt Christopher Kaufmann, US Army)

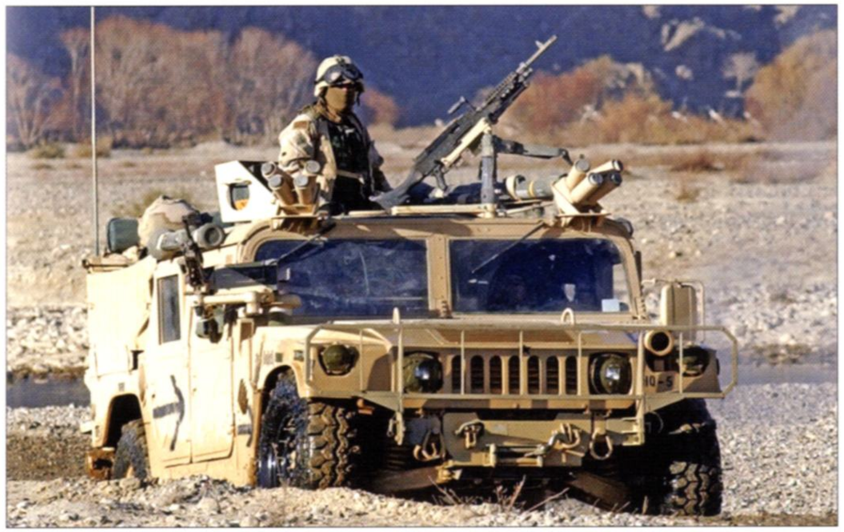
The Scout program was refined in the mid-1990s to cover a more specialized requirement for brigade reconnaissance troops, especially for the Combat Observation Lasing Team (COLT). The equipment package was first designated as the M707 Striker, but it was renamed as the M707 Knight after the Army chief of staff decided to name the new light infantry armored vehicle the Stryker. The M707 package was based on that found in the Bradley Fire Support Vehicle (BFIST) and included the G/VLLD laser range-finder/designator mounted on the roof ring mount along with an AN/TAS-4B thermal imaging night sight. Internal equipment included the Handheld Terminal Unit (HTU), Lightweight Computer Unit (LCU) with forward observer software, an inertial navigation system, and an enhanced precision lightweight GPS receiver (EPLGR). The M707 Knight was designed to be mounted on the M1025A2 HMMWV. Low-rate initial production was authorized in December 1998 and 195 were built through 2005. The Fire Support Sensor System was added from May 2004. The M707 Knight is used in brigade reconnaissance platoons in the heavy and light divisions as well as in select cavalry and artillery units. It resembles a normal HMMWV except for the added equipment.

Another innovation for scout HMMWVs is the Long Range Advanced Scout Surveillance System (LRAS3), a new long-range, second-generation thermal imaging sensor intended to replace the older first-generation AN/TAS-6. This is attached to the ring mount on other scout HMMWVs besides the Knight and the first units were equipped with this sensor in late 2001.



A sheep in wolf's clothing. The Opposing Force units at the US Army National Training Center use Vismod (Visual Modification) HMMWVs to simulate foreign vehicle types, in this case the Soviet/Russian 9P133 (BRDM-2) antitank missile carrier. (Author)

The Army's 3d Special Forces Group, Army Special Forces, developed its own customized version of the HMMWV, dubbed the "Dumvee" for Desert Mobility Vehicle, and first used it in combat in the 1991 Gulf War. The Dumvee's features have changed over the years, including many optional weapons fits, additional communication gear, extra stowage frames for long endurance missions, improved seating, the use of special tires, and other improvements. Although first converted in Army workshops, in the late 1990s the Military Systems



The Dumvee is an M1025 adapted to special operations and can be distinguished by various features such as the passenger-side machine-gun pedestal mount, smoke-grenade launchers, aggressive-pattern tires, and other modifications. This Dumvee is seen in action with the 3d Special Forces Group in the Daychopan region of Afghanistan in January 2004. (Sgt Horace Murray, US Army)

Sandin

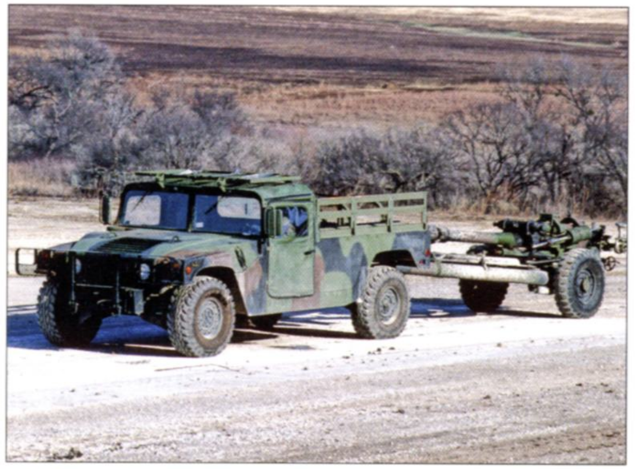
A patrol in bandit country. The Marines also use modified HMMWVs for scouting as seen here with an M1038A1 of the 15th Marine Expeditionary Unit (Special Operations) on patrol in southern Afghanistan in December 2001. It is fitted with additional weapons mounts in the rear bed as well as stowage improvements. (Sgt Joseph Chenelly, US Marine Corps)

Group in Tennessee upgraded others. US Navy SEAL teams have also apparently used the Dumvee. AM General has offered its own special forces HMMWV configuration for export, and in Britain, Alvis (now BAE Systems) developed a special forces vehicle based on the HMMWV called the Shadow.

Heavy HMMWV Variant (HHV)

The Army realized that the HMMWV could be used for a wider variety of applications than the initial variants, but that its capacity was limited by its suspension and drivetrain. The immediate requirement in the early 1990s was for a prime mover for the M119 105mm gun for use in the light divisions, but there was also interest in further shelter variants that could accommodate heavier payloads such as the J-Stars data shelter and MSE communications shelter. The baseline M998 could be converted into an M1069 prime mover using a kit, but this strained the rear axle of the HMMWV. As a result, the Army contracted AM General to develop a Heavy HMMWV Variant (HHV) designed to better accommodate heavier payloads. This variant included heavier springs and shock absorbers, heavy-duty tires, and other upgrades. The HHV was accepted for service in May 1992 as the M1097 and production was initially oriented towards replacing the M1037/-1042 shelter carriers as well as in the prime mover role. Besides the new-build HHV, an upgrade kit was also manufactured to bring older vehicles up to the HHV standard.

The HHV concept was so obvious a solution that the Army decided to take the program one step further and apply the upgrades more broadly to the HMMWV series, resulting in the -A1 series. This included the substitution of the new NP242 transfer case for the older NP218, a new front axle assembly, upgraded powertrain, upgraded suspension, a new metal hood grille, improved front seats, and modified rifle mounts. The new seats were one of the "lessons learned" from Operation *Desert Storm* and the design was based on the type of seats already introduced on civilian versions of the Hummer. The new variant was generically called the M998A1, but the -A1 suffix was simply added to the vehicles in this configuration such as M966A1 for the improved M966 TOW carrier. Of the original 15 HMMWV configurations, 13 carried on into the -A1 series. The two that were dropped were the M1036 TOW carrier (with winch) and the M1037 shelter carrier, which was replaced by the M1097 shelter carrier. About 8,800 M998A1 HMMWV variants were produced for US forces starting in early 1994 from the second contract series of 33,331 vehicles.

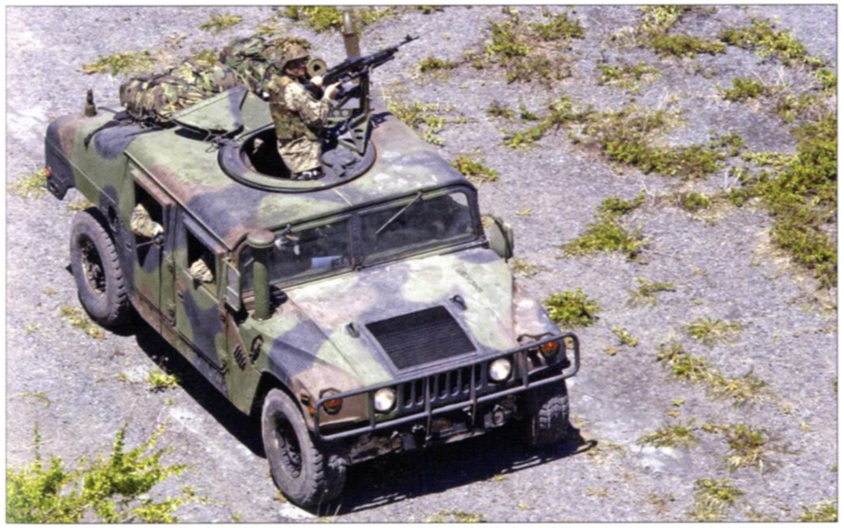


The new -A1 family of HMMWVs stemmed from the need for a more robust vehicle to serve as the M1069 prime mover for the M119 105mm light gun, as seen here at the US Army Field Artillery Training Center at Fort Sill, Oklahoma. (Author)

Although some Marine HMMWVs have supplemental armor, the baseline M998A1 troop carriers use a soft-cab like their Army counterparts. This Marine HMMWV is being backed onto a LCU (landing craft utility) during exercises on Guam in April 2003. (SSgt Michael Picklo, US Marine Corps)

Green HMMWV

The third generation of HMMWV was prompted by a 1994 Environmental Protection Agency directive aimed at reducing automobile emissions, combined with an Army interest in improving the automotive performance of the HMMWV. The twin goals took advantage of changes already



An M1043A1 armament carrier of the 3d Marines takes part in the RIMPAC 2004 exercises near Bellows Air Force Base, Hawaii, in July 2004. The -A1 HMMWVs introduced a new truck-pattern rear-view mirror, though this is not always a positive identification since some older -A0 variants were retrofitted with this feature. (Photographer's Mate 1st Class David Levy, US Navy)

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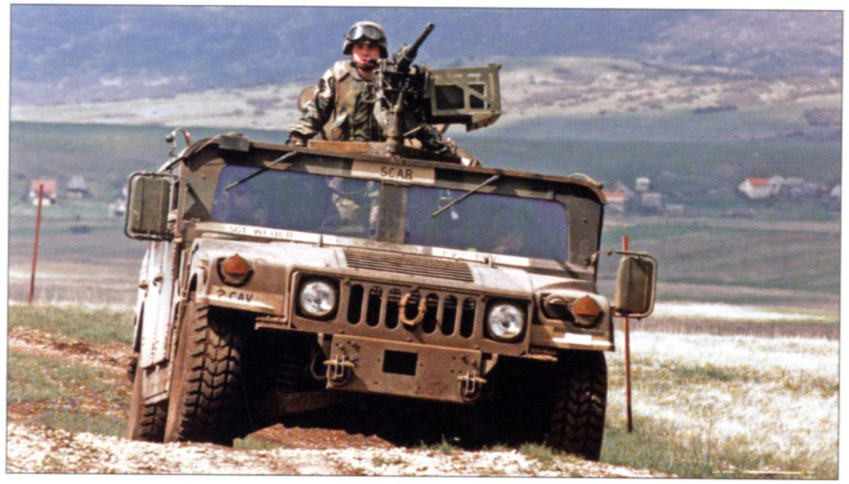
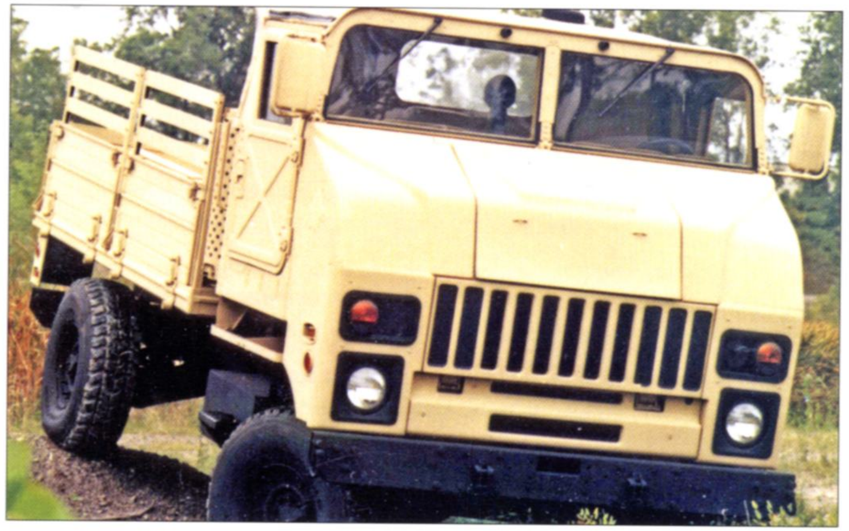
This M1114 armament carrier is from a scout team of the 2d Armored Cavalry in Bosnia-Herzegovina in May 1998, part of the Stabilization Force in Operation *Joint Guard*. The -A2 variant of the HMMWV and subsequent types can be distinguished by a revised winch mount with a larger opening compared to the small slit on the earlier -A0 and -A1 versions. (Pfc R. Alan Mitchell, US Army)



introduced into the civilian Hummers, which were obliged to operate under stricter environmental guidelines. The -A2 series replaced the baseline 150hp diesel engine with a new 6.5-liter GM 170hp diesel with the new four-speed electronically shifting 4L80E automatic transmission. Besides the powertrain improvement and changes to exhaust system, the -A2 also introduced a central tire inflation system (CTIS), which allowed the driver to lower or raise the tire pressure to suit ground conditions. By lowering the tire pressure, the footprint of the tire increases, thereby lowering the vehicle's ground pressure and allowing it to operate in softer ground conditions. Increasing the tire pressure is more economical in highway conditions since it reduces tire friction. The CTIS feature had been pioneered in earlier military applications, but in the case of the HMMWV it was actually used on civilian Hummers before the use on the -A2 family.

The -A2 configuration entered production as the new baseline standard in the fall of 1995. From this point, the Army decided to reduce the number of basic sub-types by deleting some designations, mainly those with the front-mounted winch, which became an option without its own separate designation.



Perhaps the oddest-looking variant of the HMMWV family is the COHHV (Cab-Over HMMWV), designed to provide a light truck based on HMMWV components. Although not adopted by the US Army, the reinforced chassis served as the basis for the next generation of up-armored HMMWVs. (AM General)

BASIC HMMWV VARIANTS BY SUB-TYPE

-A0	-A1	-A2 (HHV)	ECV	ROLE
M966	M966A1	M1121		TOW carrier
M973	M973A1	M973A2		Pedestal Mounted Stinger carrier
M996	M996A1			Mini-ambulance
M997	M997A1	M997A2		Maxi-ambulance
M998	M998A1	M1123		Cargo/troop carrier
M1025	M1025A1	M1025A2	M1151	Armament carrier
M1026	M1026A1			Armament carrier + winch
	M1035A1	M1035A2		Soft-top ambulance
M1038	M1038A1			Cargo/troop carrier
M1043	M1043A1	M1043A2		USMC armament carrier (supplemental armor)
M1044	M1044A1			USMC armament carrier (supplemental armor)+ winch
M1045	M1045A1	M1045A2		USMC TOW Carrier (supplemental armor)
M1046	M1046A1			USMC TOW Carrier (supplemental armor) +winch
	M1097A1	M1097A2	M1152	Cargo/troop/shelter
			M1113	Cargo/troop/shelter
	M1109		M1114	Armament carrier (armored)
			M1115	TOW carrier (armored)
			M1116	AF security (armored)

UP-ARMORED HMMWVS: FIRST STEPS

The end of the Cold War resulted in a sea change in US Army missions, with greater emphasis placed on peacekeeping missions. On many of these missions, armored vehicles would not be politically acceptable, so a protected version of the HMMWV was one possible solution. The Defense Advanced Projects Agency purchased a number of kits from Simula Government Products to provide some short-term capability. The Army contracted the specialist firm O'Gara-Hess and Eisenhardt to develop the M1109 Up-Armored HMMWV (UAH) based on the -A1 chassis for its battalion scout vehicle requirement. The aim was to make the crew compartment resistant to 7.62mm armor-piercing rounds, resistant to overhead 155mm shrapnel, and resistant underneath to small mine explosions. In the event, the armored scout vehicle requirement never materialized, but the Army acquired about 160 M1109s for military police units. It saw use in operations in Somalia during Operation *Restore Hope* in 1992, in Haiti during Operation *Uphold Democracy* in 1993, and in the former Yugoslavia in the late 1990s. A modular protective package was also developed for the HHV family that could be added to existing vehicles. Called the Add-On-Armor (AOA) kit, it included bolt-on floor panels for mine protection and additional armor panels for partial side and front protection.

The problem with these appliqué armor programs was that the added weight degraded the performance of the HMMWV, reduced durability, and limited the payload. AM General had been working on a private venture called the COHHV (Cab-Over HMMWV), which was intended to create a medium truck using reinforced HMMWV components. The Army realized that this could form the basis for an Expanded Capacity Vehicle (ECV) and contracted AM General to develop a UAH using the ECV, with O'Gara-Hess and Eisenhardt doing the armor package. The requirement was to protect

Sandini

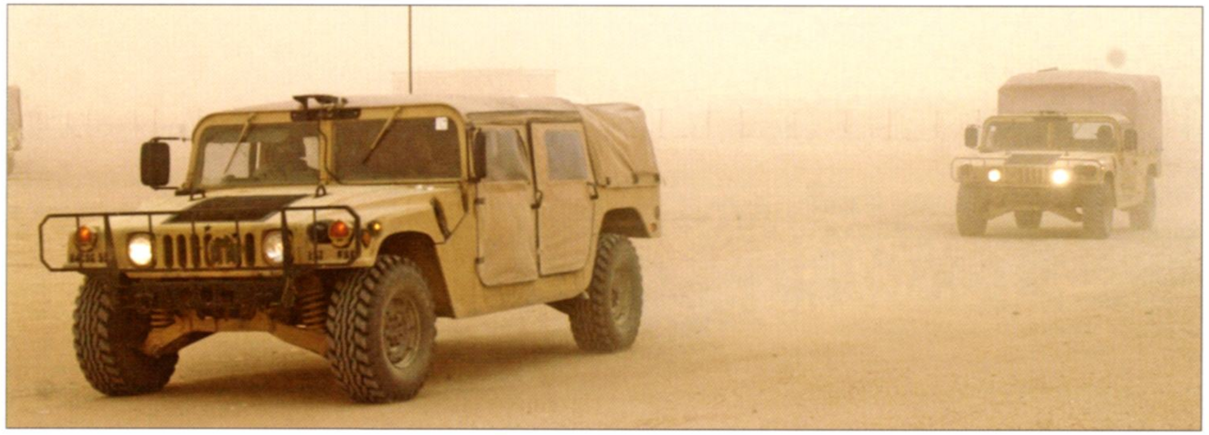
the crew from a 12lb (5.45kg) antitank mine detonated under the front axle and a 4lb (1.18kg) mine under the rear axle. Ballistic protection of the compartment doors was designed to be proof against 7.92mm armor-piercing ammunition from 328ft (100m). The basic UAH was the M1113 and the family included the M1114 armament carrier, M1115 TOW carrier, and M1116 Air Force security vehicle. The ECV configuration introduced a more powerful, turbocharged GM diesel rated at 190hp. The armor package added about 600lb (270kg) to the weight of the vehicle. The XM1114 prototype was ready in September 1995 and underwent testing at APG. Of the proposed variants, the M1115 TOW carrier was not built under the original contract, but the other types were all manufactured, starting in 1996. A small number of M1114s first saw use in a peacekeeping role in Bosnia in March 1996. Production reached 500 vehicles by November 1996 and 1,000 in May 1998.

The other major user of the M1114 family was the US Air Force, which acquired the M1116 for its security forces squadrons (SFS) who conducted airbase security. This version included a variant with a special turret developed by O'Gara-Hess and Eisenhardt to protect a standing machine gunner. The M116 went into Air Force service in May 1998. The Air Force later decided to adopt a specialized derivative of the M1114 family for use by forward air controllers. Designated as the M1145, this resembles the M1114 family but carries the necessary navigation, communication, and designation equipment needed by forward air controllers.

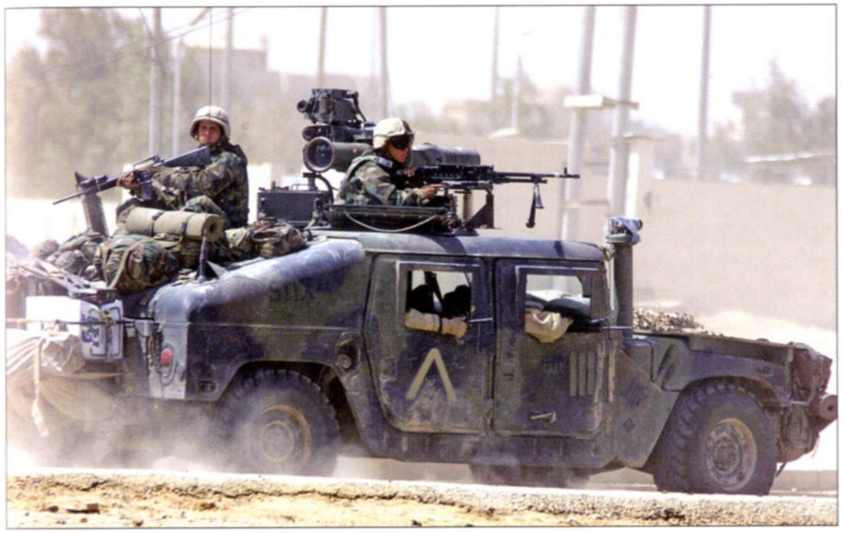
THE NEW CHALLENGE: OPERATION *IRAQI FREEDOM*

The HMMWV again saw combat service in Operation *Iraqi Freedom* in May 2003. At the time of the Iraq conflict, the US Army had over 66,000 HMMWVs in service including about 35,490 HMMWVs in the regular Army, 21,240 in the National Guard and 8,700 in Army reserve units, and 590 Avengers (see below). In light of the long lead-up to the conflict, the Army had pre-positioned 9,426 HMMWVs in the theater so that the principal Army unit involved in the initial land campaign, the 3d Infantry Division (Mechanized), arrived in Kuwait without its own equipment. By the time of the 2003 war, the HMMWV had become the principal light tactical vehicle in the US Army, as most of the older types such as the M151 Mutt and Gama Goat had been retired in 1993 after the first Gulf War. The Marine Corps had about 2,000 HMMWVs in theater at the beginning of the campaign. The Marine HMMWVs had some new features that had been installed prior to the start of fighting. For example, the Marine Corps decided to acquire the commercially developed "Gypsy Rack" for its HMMWVs, which was attached to the rear of the vehicle and could carry six jerricans of fuel plus other stowage. The HMMWV performed well during the initial fighting with availability rates of about 90 percent.

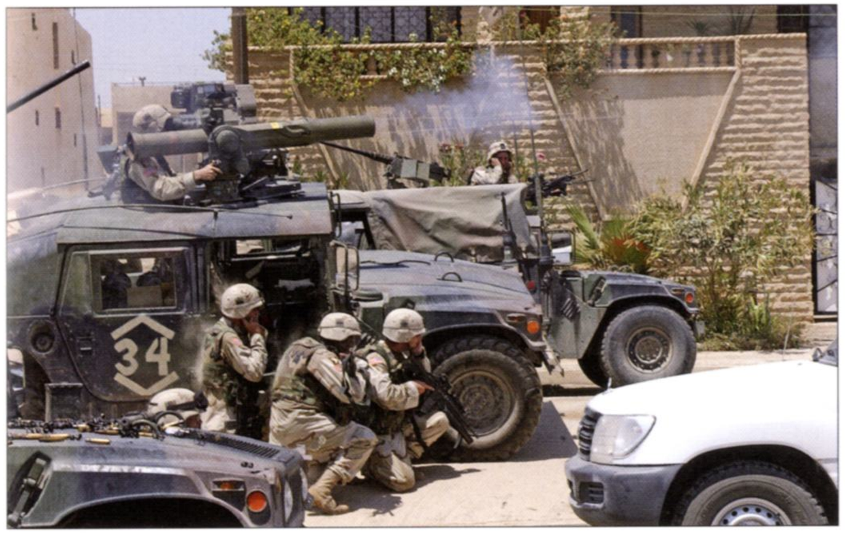
A 3d Infantry Division column led by an M998A1 troop carrier HMMWV advance on Baghdad during a heavy sandstorm on February 25, 2003. (US Army)



While the initial military campaign against regular Iraqi military units was very short, the US and coalition armed forces became involved in much more protracted peacekeeping missions in subsequent months when a variety of militant Islamic groups began staging ambushes, especially in the so-called Sunni triangle. These operations presented a significantly different challenge to the HMMWV. The HMMWV had



A Marine M1045A1 TOW carrier of Task Force Tarawa during fighting near Nasiriyah, Iraq, in April 2003. The Marine HMMWVs had many small modifications prior to the start of Operation *Iraqi Freedom*, including the addition of the commercial Gypsy Rack to the rear of the vehicle to provide more stowage for prolonged operations. (Cpl Gordon Rouse, US Marine Corps)



This photo was taken on July 22, 2003, in Mosul, Iraq, moments after the gunner on this M966A1 TOW carrier of the 101st Airborne Division fired a TOW missile at the building where Saddam Hussein's two sons were hiding. Both Uday and Qusay Hussein were killed in the assault after they refused to surrender. (Sgt Curtis Hargrave, US Army)

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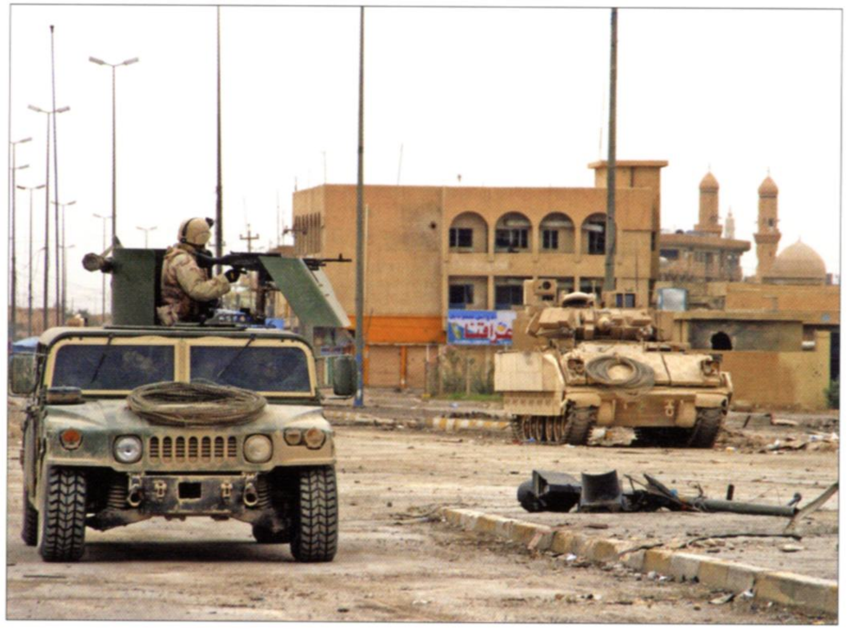
never been intended for close combat, a role that was assigned to more traditional combat vehicles such as the US Army's M1A1 Abrams tank and M2/M3 Bradley Fighting Vehicle. At the outbreak of the Iraq War, the theater requirement for up-armored HMMWVs (UAH) had been only 235 vehicles, mainly for military police. However, in pacification operations as encountered in Iraq in 2003–2005, there was no rear area, and fighting could break out anywhere, any time. HMMWVs were involved in sporadic combat on a daily basis, and subjected to small-arms fire, mines, rocket-propelled grenades (RPGs), roadside improvised explosive devices (IEDs), and other threats.

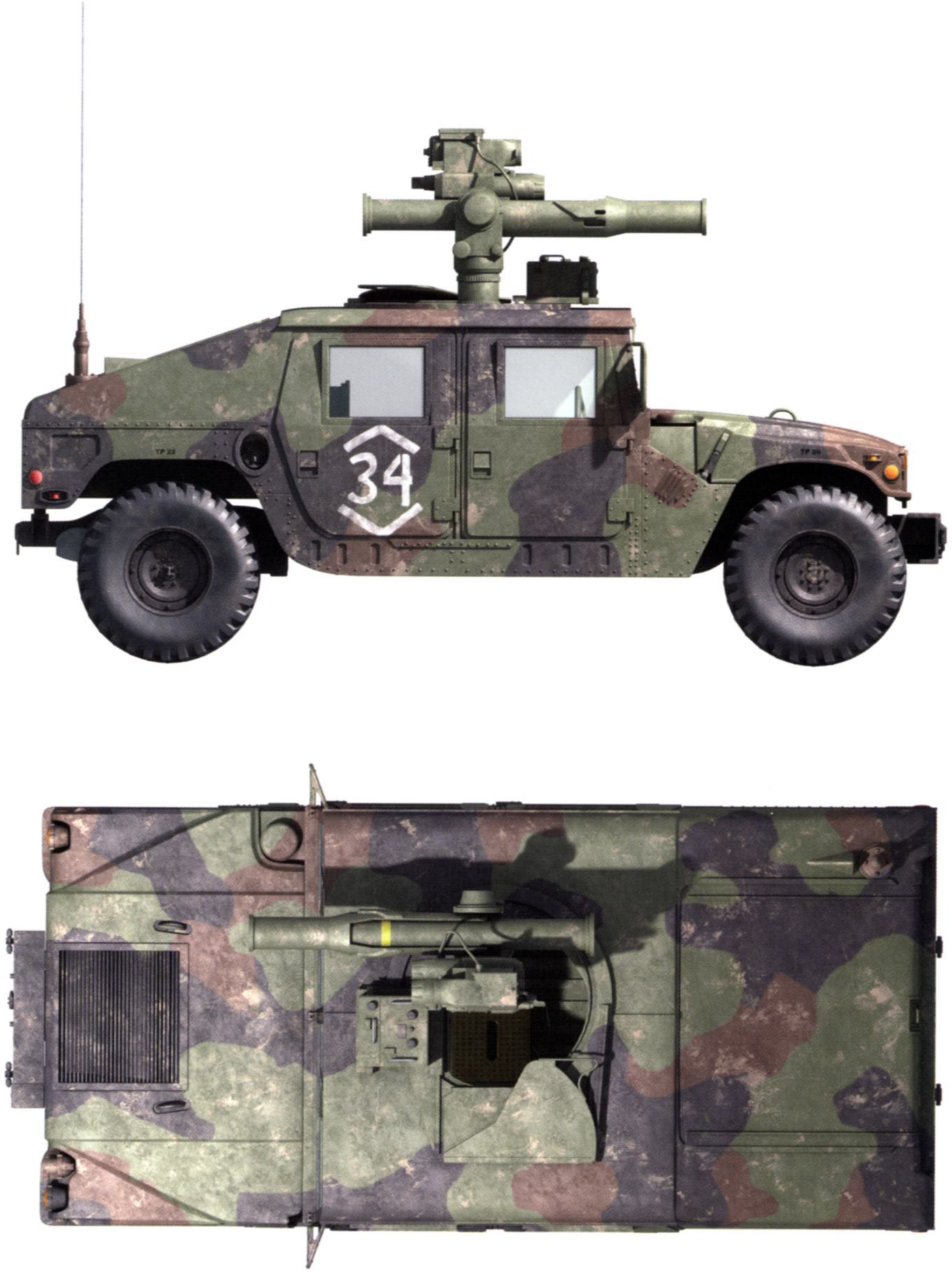
By the summer of 2003, it was clear that the number of UAHs in Iraq was too small. There was an immediate effort to shift as many UAHs to Iraq as quickly as possible, and by August 2003 there were about 2,950 UAHs in the theater, amounting to about one-fifth of the HMMWVs. The daily skirmishes and ambushes not only involved combat formations such as infantry units, but combat support units involved in convoy duty. At first, the skirmishes with insurgents in the summer of 2003 involved mainly ambushes with small arms and RPGs, but by the fall the use of roadside bombs and mines increased rapidly. Troop casualties were far higher during the pacification efforts than during the actual military campaign.

Furthermore, the nature of the campaign led the US Army to adopt tactics that placed a much greater emphasis on the HMMWV for close-combat missions. Tanks were not appropriate for urban missions or patrolling, so a number of armor units were reorganized into motorized units. A typical example was Cobra Company, 1/34th Armor, which in September 2003 switched from a conventional tank company organization of 74 tankers and 14 M1A1 Abrams tanks to a new configuration with 85 troops in three line platoons with a single M1A1 tank for fire support and 15 M1114 UAH "gun-trucks." The gun-truck companies are somewhat akin to traditional cavalry, providing mobility and



Even the Navy made modest use of HMMWVs obtained from the Marines during operations in Iraq. This M1043A2 with Marine-pattern gunner's shield provides security for Seebees of Naval Mobile Construction Battalion-4 clearing debris from the streets of Fallujah during Operation *Al Fajr* in November 2004. An Army Bradley A3 with reactive armor provides further overwatch protection. (Photographer's Mate 2d Class Philip Forrest, US Navy)

A: M966A1 TOW Carrier, 1st Brigade Combat Team, 101st Airborne Division, Mosul, Iraq, 2003



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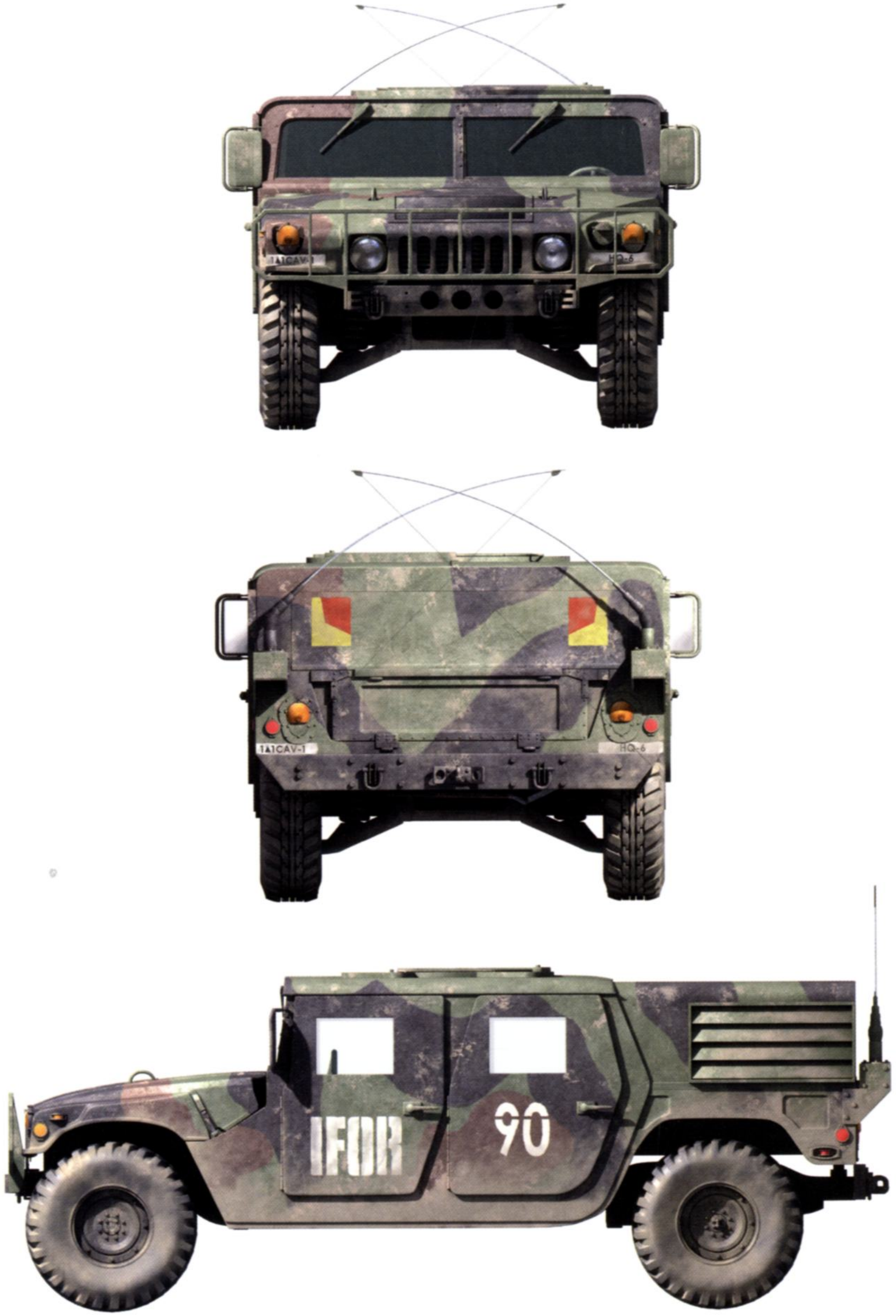
B: M1109 Heavy HMMWV, HQ, 1/1st Cavalry, 1st Armored Division, Task Force Eagle, Operation *Joint Endeavor*, Bosnia, 1996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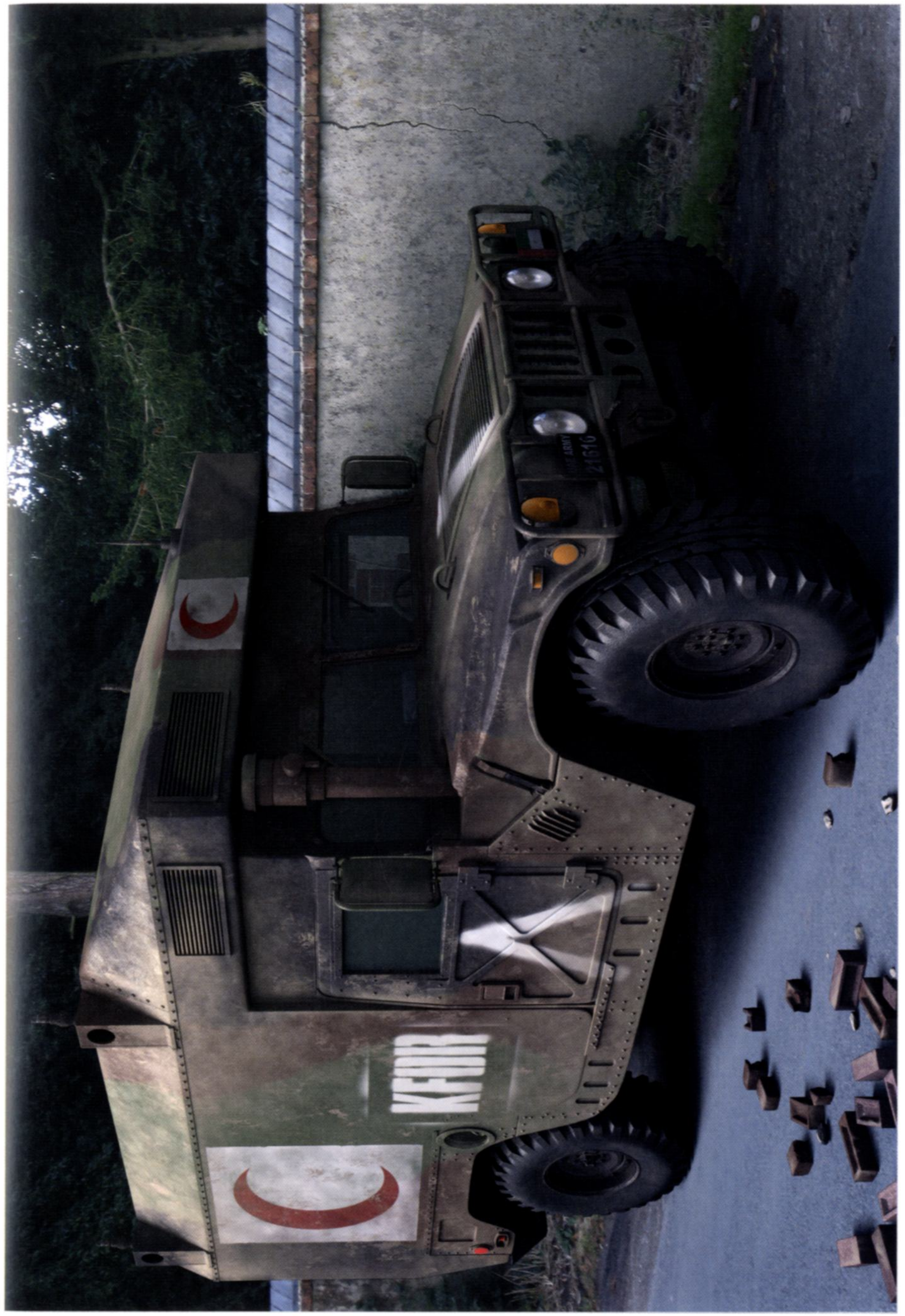

C: M997A1 Maxi-Ambulance, UAE KFOR Contingent, Multi-National Brigade (North), Kosovo, 2000

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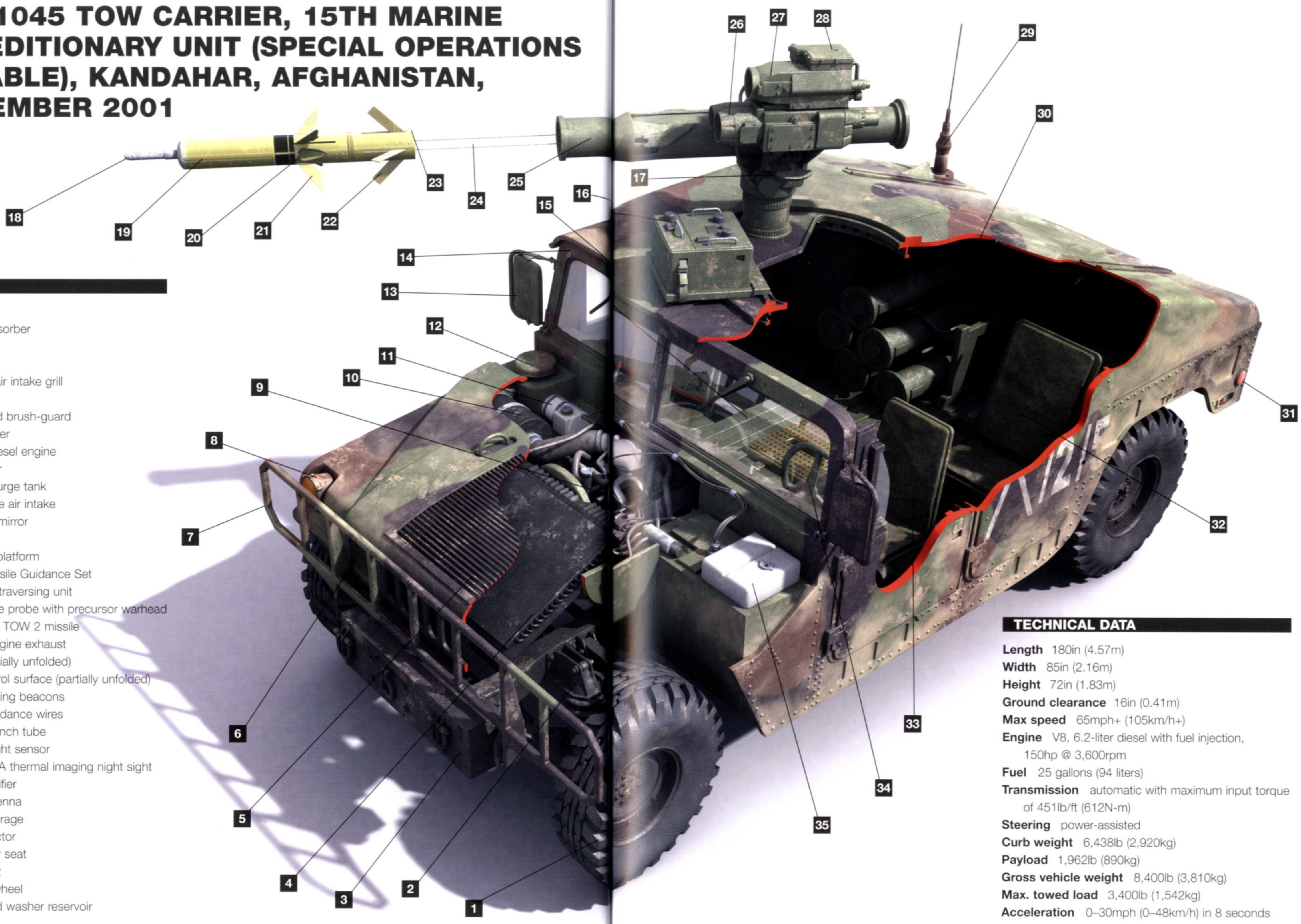
D: M1045 TOW CARRIER, 15TH MARINE EXPEDITIONARY UNIT (SPECIAL OPERATIONS CAPABLE), KANDAHAR, AFGHANISTAN, DECEMBER 2001



KEY

1 Radial tire
2 Shock absorber
3 Bumper
4 Radiator
5 Radiator air intake grill
6 Headlight
7 Reinforced brush-guard
8 Side marker
9 150 hp diesel engine
10 Air cleaner
11 Coolant surge tank
12 Extendable air intake
13 Rearview mirror
14 "A" pillar
15 Gunner's platform
16 Digital Missile Guidance Set
17 Launcher traversing unit
18 Extendable probe with precursor warhead
19 BGM-71D TOW 2 missile
20 Rocket engine exhaust
21 Wing (partially unfolded)
22 Rear control surface (partially unfolded)
23 Rear tracking beacons
24 Missile guidance wires
25 Missile launch tube
26 Optical sight sensor
27 AN/TAS-4A thermal imaging night sight
28 Post amplifier
29 Radio antenna
30 Missile storage
31 Rear reflector
32 Passenger seat
33 Driver seat
34 Steering wheel
35 Windshield washer reservoir

TECHNICAL DATA

Length 180in (4.57m)
Width 85in (2.16m)
Height 72in (1.83m)
Ground clearance 16in (0.41m)
Max speed 65mph+ (105km/h+)
Engine V8, 6.2-liter diesel with fuel injection, 150hp @ 3,600rpm
Fuel 25 gallons (94 liters)
Transmission automatic with maximum input torque of 451lb/ft (612N-m)
Steering power-assisted
Curb weight 6,438lb (2,920kg)
Payload 1,962lb (890kg)
Gross vehicle weight 8,400lb (3,810kg)
Max. towed load 3,400lb (1,542kg)
Acceleration 0–30mph (0–48km/h) in 8 seconds

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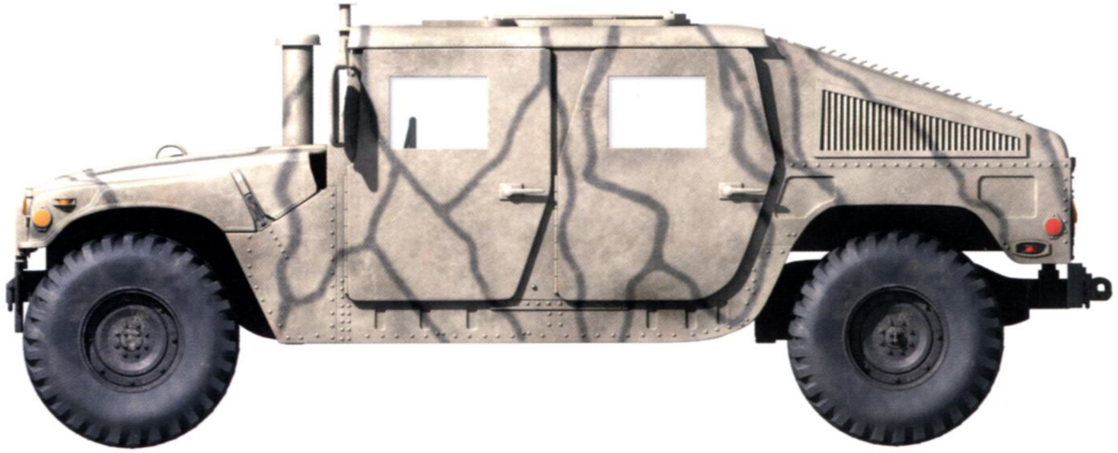
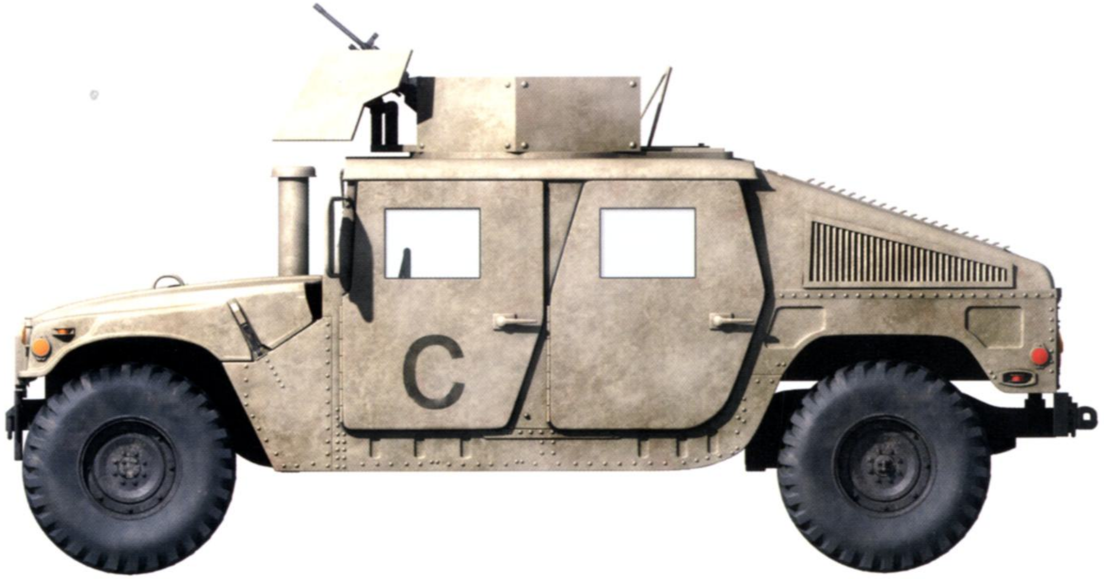
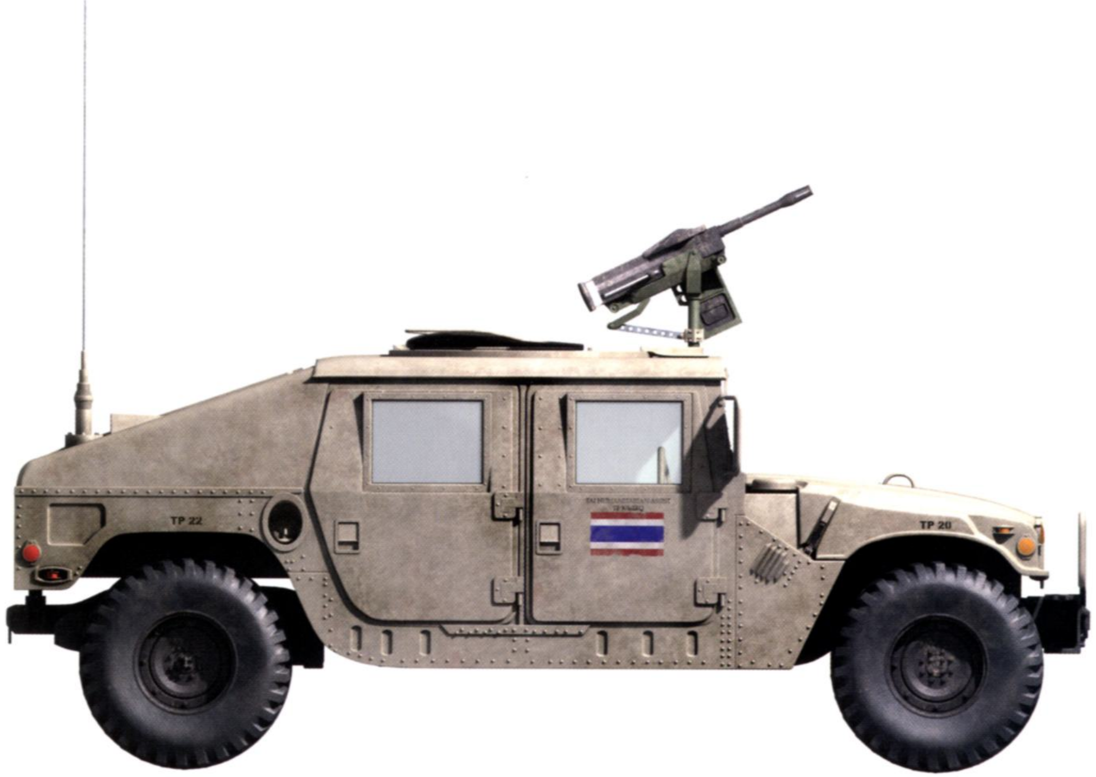
E1: M1114 UAH, 87th Infantry, 10th Mountain Division, Orgun-E, Afghanistan, April 2004



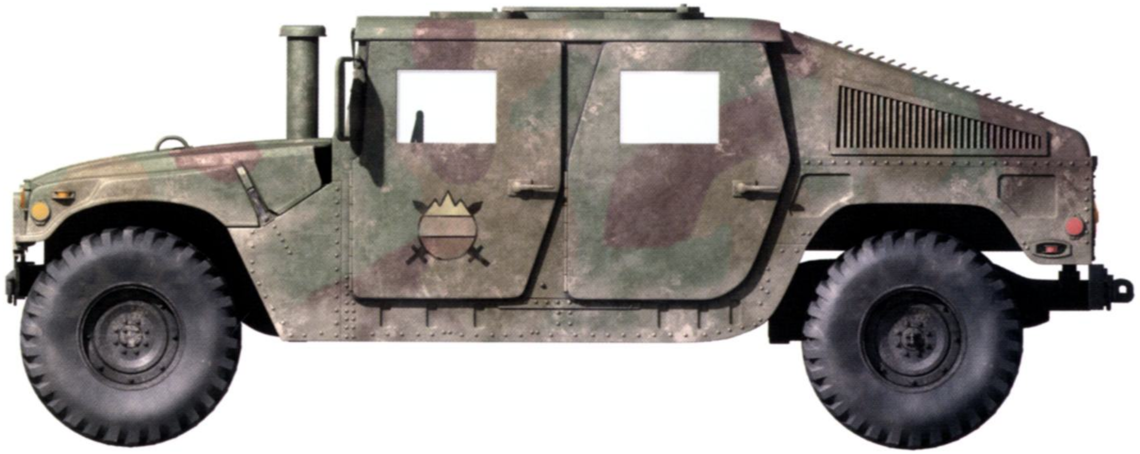
E2: M1114 UAH, Troop C, 1/11th Armored Cavalry Regiment, Baghdad, March 2005



F1: M1044A1, Thai Contingent, Multi-National Division (Central South), Iraq, 2004



F2: M1114 UAH, Slovenian Army, 2002



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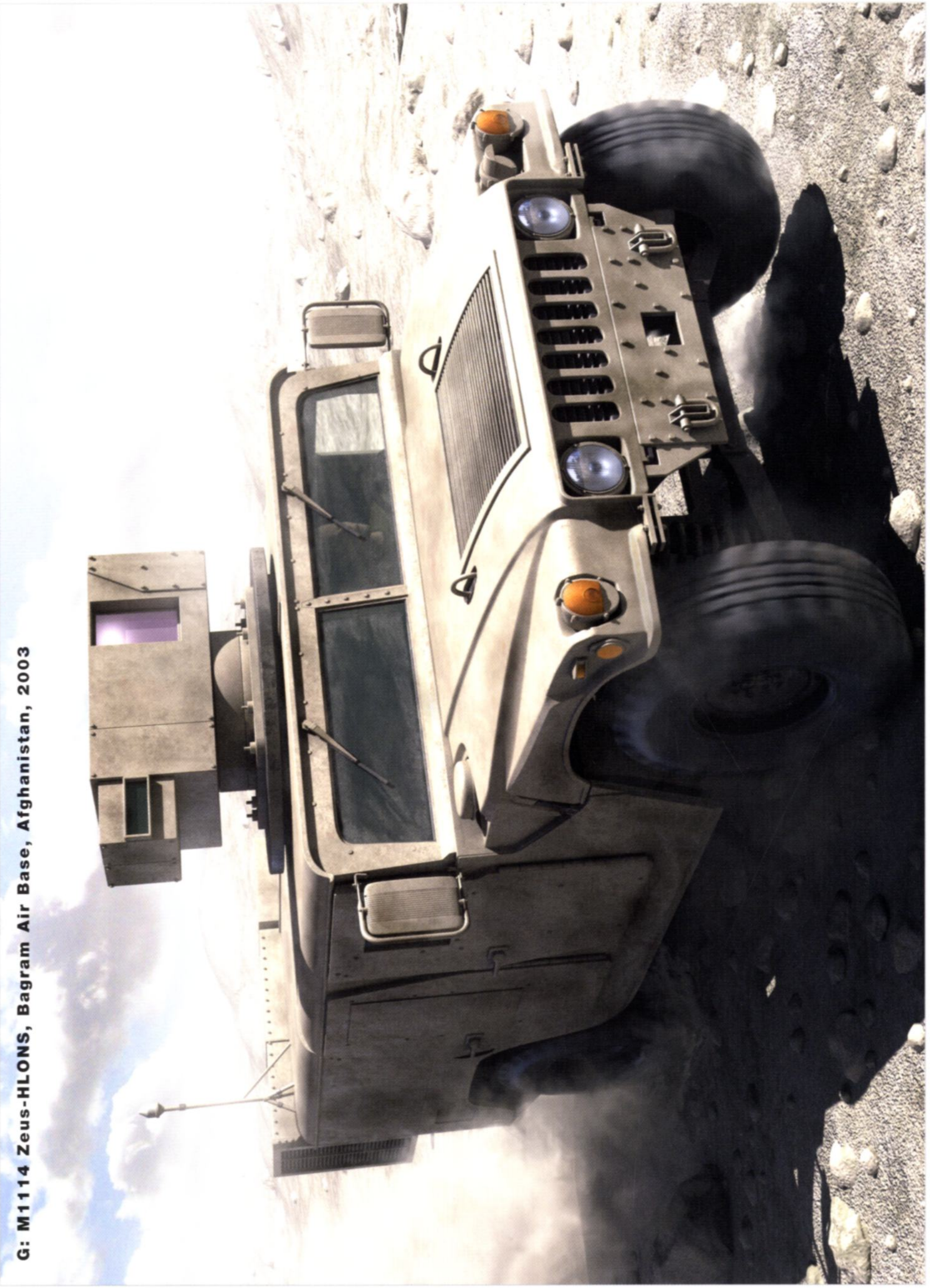

G: M1114 Zeus-HLONS, Bagram Air Base, Afghanistan, 2003

some capability to fight on the move, but mainly they provide transport for the troops who dismount to conduct patrols, with some troops remaining with the vehicles and providing overwatch with the crew-served weapons.

HARDENING THE HMMWV

The US Army began an HMMWV hardening program to address the changing role of the Humvee in August 2003. The first issue to be addressed was the amount of protection the HMMWV could actually handle. Since the Army was already operating UAHs such as the M1114, there was already some experience in how much added weight the HMMWV could sustain without adversely affecting vehicle performance. There was simply no way that an HMMWV could be fully protected against the whole range of threats. Contemporary antitank weapons being used by insurgents in Iraq included mines and antitank rockets designed to defeat 70-ton (64-tonne) tanks protected by several inches of steel armor, a level of protection the HMMWV could never match and still remain mobile. Iraqi IEDs varied considerably in power, ranging from explosives the equivalent of a hand-grenade, up to remotely detonated artillery projectiles and even 500lb (227kg) aircraft bombs. Realistically, the HMMWV could only be protected against a portion of these threats.

The US Army eventually categorized its tactical vehicle protection program in three levels. Level 1 referred to vehicles with integral up-armor kits either incorporated into the vehicle during production or during a factory retrofit. In the case of the HMMWV, this meant vehicles such as the M1114 series that had been built as up-armored HMMWVs. Level 2 was used to designate Army-approved AOA kits that were mostly installed in the field. This program began in earnest in August 2003. Level 3 referred to local initiatives to develop interim armor protection. In Iraq, this additional armor was sometimes nicknamed “hillbilly armor” and mostly consisted of adding sandbags or steel armor plates to vehicles.

The Army concentrated its attention on the Level 2 protection requirement, since it most directly addressed the need to deal with the large inventory of HMMWVs already in Iraq. This effort had two main

The need for HMMWV protection is evident in this view of an M1116 UAH of the Air Force 455th Expeditionary Operations Group, which ran into an unmarked minefield while patrolling near Bagram air base on January 5, 2005, shredding both tires. Both airmen were uninjured, as seen here. (Tech Sgt Brian Davidson, US Air Force)

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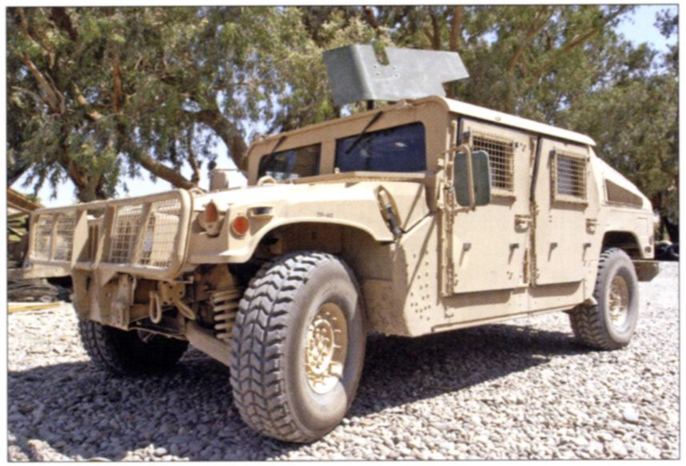
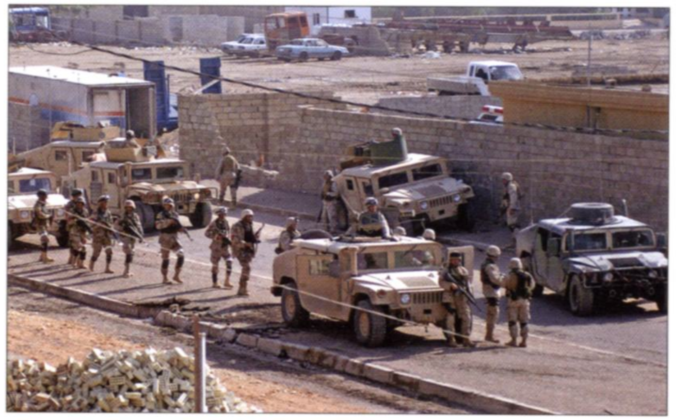
components – an Army Research Lab (ARL) effort to develop standardized HMMWV AOA kits, and a program to examine AOA proposals from industry. By the end of 2004, the Army had received 207 different armor proposals from 40 different companies. Some of these were from established armor manufacturers, notably Armor Holdings Inc., which had acquired the two main vehicle armor companies O'Gara-Hess and Eisenhardt in 2001 and Simula in 2004. Some of the proposals were from well-intentioned but less experienced firms. In the case of one kit that was tested, the package was so heavy that it snapped the front driveshaft of an HMMWV during a 10mph (16km/h) braking test. In the end, 12 of the commercial AOA kits were promising enough that the Army conducted live-fire tests against them at Aberdeen Proving Ground. These tests including penetration tests using small arms and simulated IEDs as well as complete vehicle tests involving mines, IEDs, and RPGs. Apart from the ballistic tests, the AOA kits also had to be subjected to safety and performance trials, since the added weight could adversely affect steering, braking, and durability. While the Army was testing the AOA proposals from industry, the ARL at Aberdeen Proving Ground was developing its own kit.

The Army established an initial requirement for 8,400 AOA kits in November 2004, but this figure was continually raised until it reached 13,872 kits in September 2004, aimed at protecting all HMMWVs in the Iraq combat theater. In the end, the Army decided to adopt four kits for the Level 2 requirement for the HMMWV, primarily the ARL kit, but several industry-developed kits as well. Such multiple sourcing was due to the need to field the kits as quickly as possible, and since there were limits on the short-term production capacity at some plants, it was prudent to spread out the work to several private and government facilities rather than adopt a single kit.

As an interim solution until their own Add-On-Armor kits became available, some Marine units in Iraq received M1114 UAHs from the Army or M1116s from the Air Force, like this M1114 serving with the 2/4th Marines in June 2004.



The ARL package was dubbed the Armor Survivability Kit (ASK). The first batch of 15 ASK kits was constructed at the ARL facility at Aberdeen Proving Ground and shipped to the HMMWV Service Center at Camp Anaconda, Iraq, in November 2003 with 85 more early production kits arriving soon afterward. The first unit to receive the ASK kits was the 18th Military Police Brigade. To permit large-scale manufacture of the kit, the effort was extended to several Army facilities starting with the Ground Systems Industrial Enterprise (GSIE) at Rock Island Arsenal, Illinois. The first batch of 180 GSIE ASK kits was shipped to Iraq in November 2003. The initial kits were configured for the two-door versions of the HMMWV, but since a larger percentage of the fleet was four-door, a four-door kit was soon developed. The production program was later extended to Anniston Army Depot, Alabama; Red River Army Depot, Texas; Sierra Army Depot, California; Watervliet Arsenal, New York; and Letterkenny Army Depot, Pennsylvania, with an overall requirement for 8,000 ASK packages. The kits were shipped to Army facilities in Iraq for incorporation on HMMWVs, principally to Camp Udairi, Camp Arifjan, and Camp Anaconda. There were a number of changes to the kit during the course of production, including features to permit the new armored windows to be opened sufficiently for use as firing ports. An unexpected problem encountered when using the kits in Iraq was the need to provide air-conditioning, since the armor kit enclosed the crew compartment, cutting off air circulation. Over 6,000 Red Dot vehicle air conditioners were ordered in early 2004 to retrofit the HMMWVs with enclosed compartments.

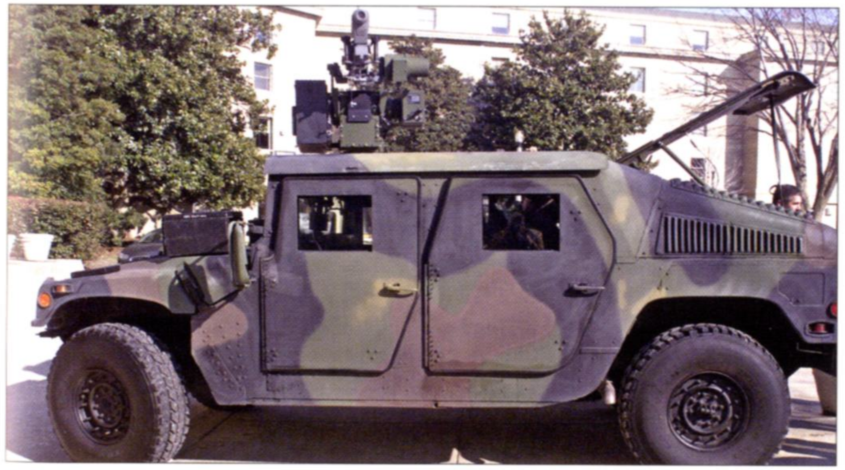


Although not designed for close combat, the HMMWV was often used to provide both mobility and fire support during operations in Iraq and here several are seen on patrol during the violent fighting in Fallujah during Operation *Al Fajr* in November 2004. The HMMWVs include an assortment of up-armored types, mainly M1114 UAHs but also older marine HMMWVs with the interim hardening package. They are supporting troops from the 5th Battalion, 3d Brigade of the New Iraqi Army. (Sgt Clinton Firstbrook, US Marine Corps)

The Army extended the AOA program to private industry as well once its own kits had been tested and verified. Armor Holdings Inc. was contracted to build kits based on its previous experience with the M1114. These were often dubbed OGH kits after the O'Gara-Hess facility that was producing them. Testing of the OGH kits was completed in May 2004, and production ramped up to 500 per month by the fall of 2004. Besides the OGH kit, the firm was also contracted to provide the Gunner Protection Kit, which was a parapet and gun-shield arrangement to protect the solider operating the roof-mounted weapon. ArmorWorks was contracted to manufacture 1,500 of their Ballistic Advantage Kit for troop carrier versions of the HMMWV. This kit was designed for the two-door M998/M1038 HMMWVs in pick-up truck configuration and provided both side vehicle protection as well as reconfigured seating in the rear bed, permitting the troops to aim their weapons outward.

Within a year's time, most of the HMMWV fleet in Iraq and Afghanistan had been up-armored. By the middle of December 2004, there were 6,056 UAHs with Level 1 protection, 9,207 HMMWVs with Level 2 kits installed, 847 with Level 3 "hillbilly armor," and about 3,000 unarmored HMMWVs waiting for kits. The deliveries of the kits were completed in April 2005.

Another aspect of the Iraq protection effort was a program to reduce the vulnerability of the vehicle gunner. Besides the various attempts to



The ultimate package for protecting the HMMWV consists of the Add-On-Armor package as well as the CROWS remote-controlled weapon station, which allows the crew to operate the vehicle weapon from within the vehicle. This vehicle was displayed at the Pentagon in February 2004. (US Army)

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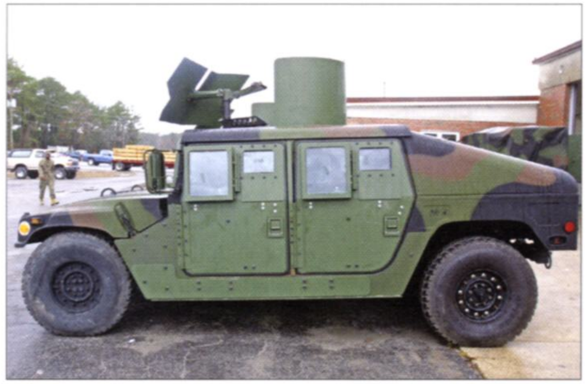

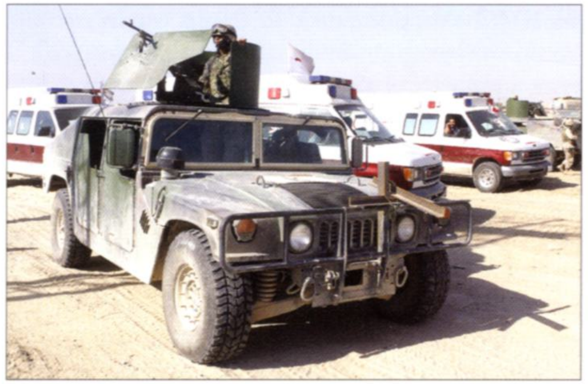

TOP LEFT **The Marine Corps developed its own up-armor package for Iraq called the MAK, seen here fitted to an M1043A1 weapons carrier of the 26th Marine Expeditionary Unit in December 2004, shortly before the unit was deployed to Iraq. (Lance Cpl Daniel Lowndes, US Marine Corps)**

TOP RIGHT **This is a good example of a Marine HMMWV with locally fabricated interim armor on the doors, along with a standard gun shield and the added curved side shield developed to give the gunner better protection. This particular M1043A2 from 2/11th Marines was providing security to an Iraqi Red Crescent Society convoy bringing relief supplies to civilians near Fallujah during the intense fighting there in November 2004. (Lance Cpl Daniel Klein, US Marine Corps)**

deploy armored shields around the weapons station, the US Army also decided to examine remote-control gun stations based on a military police requirement. The station eventually selected was the Recon/Optical Inc. XM101 Crew Remotely Operated Weapon Station (CROWS). The CROWS is a modular weapon system that can be fitted with a variety of light or heavy machine guns or the Mk 19 40mm grenade launcher. Prototype systems were deployed to Iraq in December 2003, mainly on military police vehicles including the M1114 UAH.

The Marine Corps followed its own path in reinforcing its HMMWVs. As in the case of Army "hillbilly armor," Marine units in the field began reinforcing their HMMWVs with a variety of expedient armor panels, especially reinforced doors and shields for the gunners. This improvisation quickly became an organized program by the 1st Marine Expeditionary Force's Service Support Group (FSSG) in Iraq and was later labeled as first-generation "interim hardening." The next step, coordinated by the Marine Corps Logistics Center, was called second-generation "zonal hardening" and aimed at a more comprehensive protective package, including antimine protection. Zonal hardening used locally constructed material as well as AOA kits obtained from firms in the United States. In the meantime, the Marine Corps Systems Command and Marine Corps Logistics Command began working with the Army on an up-armor kit, but eventually decided to develop their own armor package called the Marine Armor Kit (MAK). The MAK is significantly heavier than the comparable Army packages, weighing 1,800lb (818kg) in the baseline version and 3,400lb (1,545kg) in the full-up kit. The first unit equipped with the definitive MAK system was the 26th Marine Expeditionary Unit in December 2004 prior to its deployment to Iraq, and retrofit of vehicles in Iraq began in February 2005 with a goal to field 3,100 MAK packages. The Marine Corps also ordered 498 M1114 UAHs, but since these would not be available immediately, the Army and Air Force transferred 423 UAHs of various types to the 1st Marine Expeditionary Force in Iraq.

NEW PROBLEMS: EXOTIC SOLUTIONS

Besides the use of passive armor, the US Army also began fielding active protection systems in 2003 aimed at disabling IEDs. Many of the Iraqi IEDs were remotely detonated using cell phones, remote-control door-openers, and other commercial remote-control devices that depend on radio signals. The US Army had been developing the Shortstop Electronic Protections System (SEPS) to defend against more conventional weapons relying on radio signals, such as artillery projectiles using proximity fuzes. This technology could also work against the remote-control IED threat, so devices such as this were fielded in Iraq in 2004.

One of the more exotic systems considered for the IED threat was the Zeus-HMMWV Laser Ordnance Neutralization System (HLONS). This is a turreted solid-state diode-pumped Nd:YAG laser with an output energy of about a half kilowatt in the early version. The Zeus is fitted in a small turret on the roof of an M1114 UAH and has an effective range of about 885ft (270m). The device emits enough energy to cause the explosive in a mine or projectile to either burn or explode. Zeus was designed primarily to deal with unexploded ordnance at a distance to limit the risk to engineer de-mining teams. The laser can detonate most munitions from a distance sufficiently outside the blast radius, or in cases involving large munitions, the system can be operated remotely. The Zeus-HLONS was first deployed to Afghanistan in March 2003 and used around Bagram airfield to deal with old minefields and unexploded ordnance, dealing with over 200 explosive devices. This was the first time a medium-energy laser weapon had actually been employed in a combat theater. The US Army had deployed a small number of Stingray laser systems on the Bradley in 1991 in Iraq, but they had not been used. Besides the Zeus, the Army's Space and Missile Defense Command has developed a weapons-level laser called the Solid State Laser (SSL) designed to shoot down antitank missiles, mortar rounds, and other projectiles. Demonstration tests of an SSL mounted on an M1124 HMMWV were conducted at White Sands Missile Range as a potential forerunner of an actual weapon system sometime in the future.

Another exotic system planned for deployment in Iraq was the Sheriff Vehicle Mounted Active Denial System (VMADS). The Sheriff consists of an antenna that emits non-lethal high-energy microwaves and was developed in 2000–2001 as part of the Joint Non-Lethal Weapons Program. The system is intended for coping with crowds of civilians where the use of lethal force would be inappropriate. VMADS emissions cause a painful burning sensation on the skin that is intended to repel crowds rather than injure them. The program was initiated in the summer of 2004 after a number of confrontations between US troops and civilian mobs in Iraqi cities. The plan was to deploy the Sheriff system on Marine Corps LAV light armored vehicles and on Army HMMWVs, with the first units in service by September 2005.

21ST-CENTURY HMMWV

In 2000, the Army decided to start a program to rejuvenate its light tactical vehicle fleet. The HMMWV had proven to be well suited to the Army's need, but since production had begun in 1985, inevitably some of the fleet was approaching the end of its useful life. When first built in 1985, the expected life of the HMMWV was 15 years, so the first vehicles exceeded this level in 2000. At first, the Army considered a "recap" (recapitalization) program including a new engine, drivetrain, and other parts, but the overall cost per vehicle would have been about $40,000. This outlay didn't make financial sense, so instead the Army decided to acquire at least

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Troops of Task Force 2-63d Armor pull security at a checkpoint near Baqubah, Iraq, in June 2004. This close-up shows the prominent nose of the ECV variants of the HMMWV family like this M1114 UAH. Also noteworthy is the larger winch opening characteristic of the -A2 variants and later models. (Sgt Kimberly Snow, US Army)

another 45,000 new production HMMWVs, and rebuild some of the remaining fleet. At the time, the HMMWV production standard was the -A2 series, so the new production began with this version. The Marine Corps followed suit, starting to replace a portion of its existing inventory of some 17,800 HMMWVs with the new generation -A2. The first Marine -A2s were delivered in December 1998.

The war in Iraq in 2003 intervened during the course of this program, and led the Army to rethink its needs. As is evident from the discussion above concerning the need for up-armored HMMWVs in peacekeeping missions, the Army realized that a larger portion of its future fleet should either be armored from the outset, or configured to readily accept an armor package with minimal effort. Since the Expanded Capacity Vehicle (ECV) was already in production for the M1114 series of up-armored HMMWVs, this was the logical place to start. The idea was to adopt HMMWVs with the reinforced chassis and up-rated powerplant, though not necessarily with the armor package in place. This new configuration was called "Armor Ready," that is, ready to accept an AOA package if need be, but left unarmored in peacetime to reduce the wear and tear on the vehicle that the heavy armor package entails. Two basic versions were developed, the M1151 armament carrier with a 2$\frac{1}{10}$-ton (1.9-tonne) payload capacity to replace the M1025 series, and the M1152 cargo/shelter version with a 2$\frac{1}{2}$-ton (2.3-tonne) payload capacity, replacing the M1097 series. Testing of the XM1151 and XM1152 prototypes took place in 2004, including air-drop tests. A production contract for the first M1151 was awarded in November 2003 and the first vehicles were delivered in August 2004. The contract for the Armor Ready M1152 was awarded a year later in November 2004 with first deliveries in March 2005.

The second element of the Army program was the reduced recap program aimed at rebuilding older vehicles to extend their useful service life. The program originally started in October 2001 as an effort to support the "Counter Attack Corps" with refurbished vehicles. However, the program expanded in the wake of the Iraq conflict with the need to rebuild a larger number of vehicles worn down by intensive use. The recap program involves older M998, -1037, and -1038 HMMWVs, and the rebuilt vehicles are then recategorized as the M1097R1. The recap vehicles have the "Armor Ready" features added and the plan is to recap 8,367 HMMWVs in 2006–12.

By the late 1990s the US Marine Corps' HMMWV fleet was in much the same situation as the Army's, and in 1998 the Marines decided to gradually replace their HMMWV fleet with the -A2 generation. A total of over 17,000 new HMMWVs are scheduled to be purchased from 2001 to 2009.

The Army began to look at alternatives to conventional power for light tactical vehicles in 1987 with an early study on hybrid electric vehicles. The aim of the program was to lower the amount of fuel needed by Army units in field conditions. A prototype hybrid electric HMMWV was completed in 1993 followed by a newer Generation I vehicle in 1997 and a Generation II vehicle in 1999. None of these test-beds proved to be mature enough to consider for mass production, so in 2004 the Army developed plans for yet another hybrid electric HMWWV using a 2.2-liter, 97hp generator, with electric traction motors at each axle and an associated battery pack.

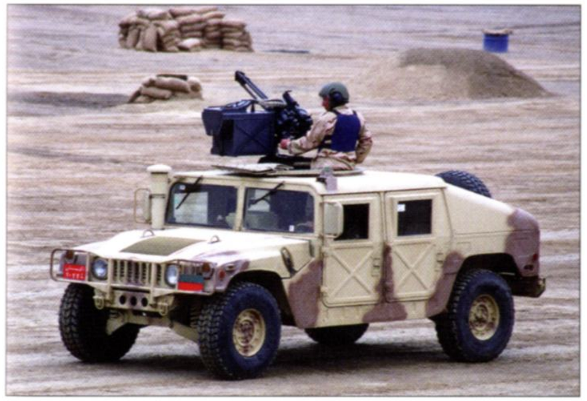
INTERNATIONAL HMMWV

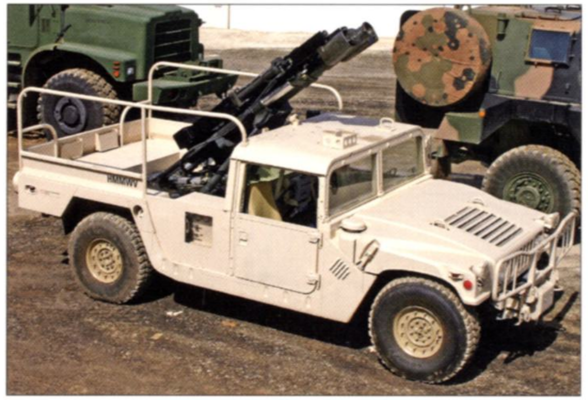
The HMMWV attracted considerable foreign attention at the time of Operation *Desert Storm*, and a significant number of armies decided to adopt the HMMWV for their light tactical vehicle requirements. By 2005, over 30 countries had purchased the HMMWV including Algeria, Argentina, Bahrain, Bolivia, Chad, Colombia, Djibouti, Ecuador, Egypt, Ethiopia, Honduras, Israel, Jordan, Kuwait, Luxembourg, Mexico, Morocco, Oman, Philippines, Poland, Qatar, Saudi Arabia, Slovenia, Spain, Sudan, Switzerland, Taiwan, Tanzania, Tunisia, Turkey, Uganda, United Arab Emirates, and Venezuela. Many of these armed forces operate relatively small numbers of HMMWVs with their special forces units or marines. So for example, Spain operates the HMMWV mainly with its marine units, while the Poles acquired 217 HMMWVs in 2003 for their 18th Air Assault Battalion. The international HMMWVs have seen some use in recent peacekeeping operations. The UAE deployed HMMWVs with its peacekeeping force in Bosnia in the 1990s, and the Poles deployed a small number of their HMMWVs with their peacekeeping forces in Iraq in 2005. (As has been the case with US forces, many armies have adapted their HMMWVs to the peacekeeping role.) The Poles modified a portion of their HMMWVs into the "Trynka" configuration, which uses an armor shield on the gunner's roof station and is fitted with a 12.7mm heavy machine gun and NT Spike antitank missile launcher. Some of the specialized HMMWV variants have also been exported. For example, the PMS Avenger air defense vehicle has been exported to Egypt and Taiwan.

The international HMMWV has also formed the basis for a number of derivative types. In the early 1990s, the Swiss armored vehicle company MOWAG developed the Eagle light armored vehicle using the HMMWV chassis to satisfy a Swiss Army requirement to serve as reconnaissance vehicles in the armored brigades. In 1994, the Swiss Army placed an order with MOWAG to provide 151 Eagles and in January 1998 this program was

BOTTOM LEFT **A variety of armament options have been proposed for international HMMWV operators. This is an M1025A1 armament carrier of the UAE Army at the Maqatra range in Abu Dhabi fitted with a GAU-19/A 12.7mm externally powered Gatling gun for increased firepower. (Author)**

BOTTOM RIGHT **The more robust Heavy HMMWV Variant family permits more elaborate armament options, like this Singapore Technologies Super Rapid Advanced Mortar System (SRAMS), which can fire up to 18 120mm mortar rounds per minute. It was first displayed in February 2005 at the IDEX show in the United Arab Emirates. (Author)**





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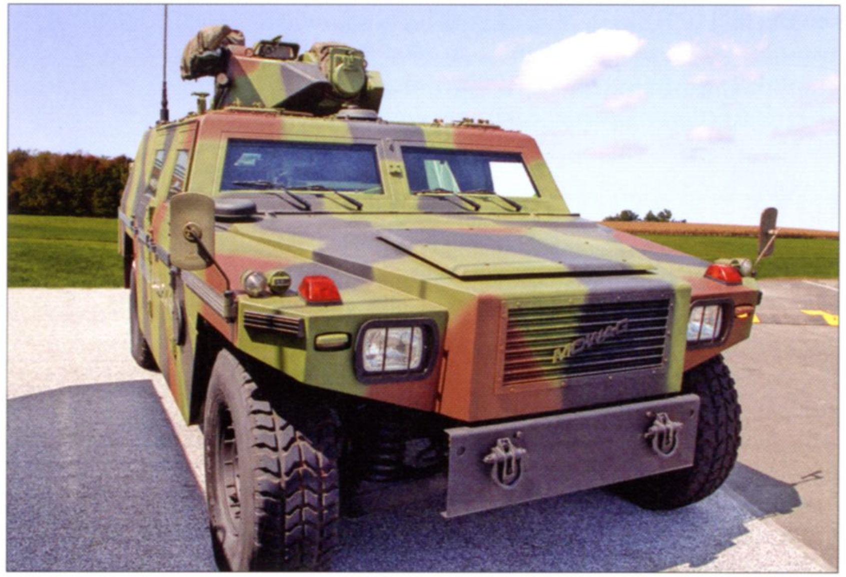
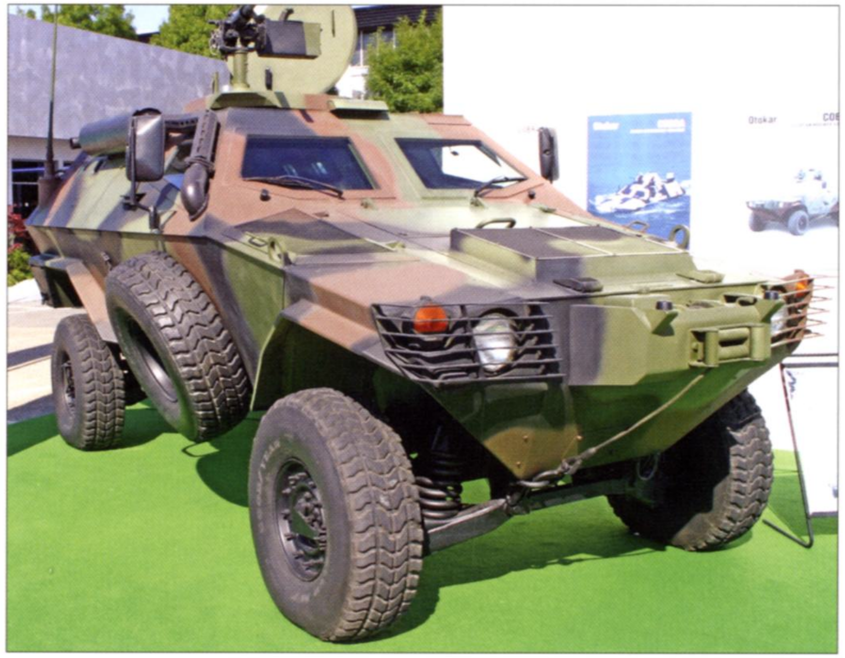
MOWAG developed its Eagle armored reconnaissance vehicle using the HMMWV chassis, but with a new armored body and a turret for a Swiss Army requirement. (Author)



extended with the purchase of a further 175 Eagle II vehicles. MOWAG has also sold the Eagle to the Danish Army. The Turkish automobile manufacturer Otokar developed the Cobra armored reconnaissance and scout vehicle, which uses the HMMWV suspension and powertrain, but fitted to a fully armored body. The first eight prototypes were completed in 1996 and the Turkish Army began acquiring them in 1998.

The success of the HMMWV has strongly influenced other military truck manufacturers, and has led to the emergence of many light tactical trucks clearly patterned on the HMMWV. Some of these, such as two Chinese types – the Shanghai SQF2040 and the Dong Feng EQ2050 – are such close replicas of the HMMWV that they are difficult to distinguish except for small details. Other designs closely mimic the configuration and general appearance of the HMMWV, though are not direct copies.



Otokar's Cobra is a light armored car using the HMMWV suspension and powertrain, but with a fully armored body. It has been built for the Turkish Army and at least one other army. (Author)

MISSILE HMMWVS

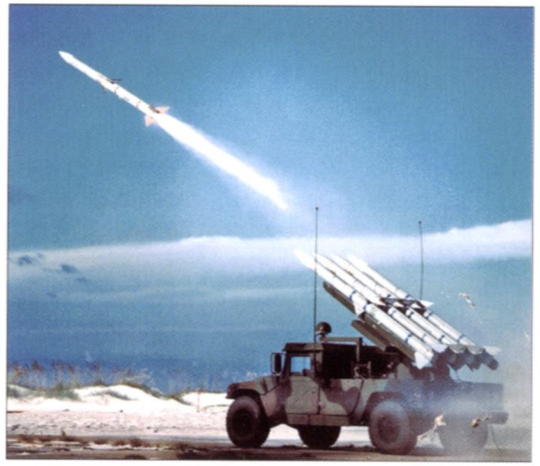
The Avenger air defense vehicle proved to be an effective low-cost air defense system, so the US Army continued to upgrade it through the 1990s. The first step was the Avenger Product Improvement Program (PIP). This program included enhancements to the vehicle power system, a new interface enabling the Avenger to work with forward area air defense networks, and an improved fire-control system that allowed software upgrades for the system and Stinger missile, thus avoiding the need for hardware changes. The modification program was funded in 1992–95.

The Army began a second upgrade program called Avenger Block II in 1999. Some new features were adopted, including a slew-to-cue feature (where the gunner cues the target using a special sighting device, and the turret automatically slews to the proper position), but the Army trimmed back its air defense program in 2001–2002, including plans to field more Avengers. The Avenger proved to be a popular system during peacekeeping missions in Bosnia and Kosovo in the 1990s due to its thermal imaging night-vision system. The system was an excellent surveillance tool, and Avengers were often deployed at roadblocks to take advantage of this feature. Another unexpected deployment for Avenger was in the homeland defense role after the 9/11 attacks. Avengers have been repeatedly deployed around Washington, DC, and other locations to prevent the use of suicide aircraft attacks against prominent buildings or public events.

Besides the Avenger, a number of other air defense versions of the HMMWV have been proposed or actually fielded over the years. Most of these proposals involve smaller man-portable missiles comparable to Stinger. So for example, the UAE Army has fitted some of its pedestal-mounted French Mistral missiles on its HMMWVs. A number of commercially produced launchers have also been developed, including a German proposal using the Autonomous Short Range Air Defense missile system (ASRAD) on the HMMWV that can fire the Stinger or comparable missiles such as the Russian Igla.

The most elaborate of the missile HMMWVs is a more recent program to mount the AIM-120 Advanced Medium Range Air-to-Air Missile (AMRAAM) on an HMMWV to create a low-cost air defense vehicle. In 1996, the US Army demonstrated an AMRAAM launcher mounted on an HMMWV dubbed "HumRAAM" to fill the gap between the low-altitude Stinger and high-altitude Patriot. Army air defense was in a state of turmoil at the turn of the century and no final decision was made on HumRAAM, or its later incarnation SlamRAAM (Surface-launched AMRAAM). However, the Marine Corps was unable to afford the Patriot and had been obliged to retire its old HAWK air defense missile, so was in the market for a system with more capability than the Avenger. In 1997, the Marines began to examine the

The Army promoted an HMMWV launch system for the MIM-120 AMRAAM missile, called variously the HumRAAM, SlamRAAM, and CLAWS. This provides air defense capability between the short-range Stinger and long-range Patriot, and is being acquired by the Marines. (Raytheon)



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The MGM-166A LOSAT is a hypervelocity antitank missile that penetrates the thickest tank armor by sheer speed rather than high-explosive punch. It was built in small numbers for use by rapid-entry units to provide some highly mobile firepower during contingency operations until heavy forces arrive. (Lockheed Martin)

Army's HumRAAM idea under their own name, Complementary Low Altitude Weapon System (CLAWS). The Marine Corps examined competing designs from Boeing and Raytheon, selecting the Raytheon design in April 2001. At the time this book was written, the Marines were on the verge of buying the CLAWS. The Air Force has also expressed some interest in the system as a means to protect its forward-deployed Air Expeditionary Force and the Army is still considering acquiring the system as well.

One of the most ambitious Army missile programs was the MGM-166A Line-of-Sight Anti-Tank (LOSAT), a hypervelocity laser-guided antitank missile system developed by the US Army to replace the M901 Improved-TOW Vehicle (ITV). The development effort kicked off in 1991, but ran afoul of technical problems due to the difficulty of steering a missile that travels at about half a mile per second. Although it was originally scheduled to be mounted on a tracked vehicle, the LOSAT was eventually mounted on an M1114 HMMWV to make it more suitable for use by light forces. The M1114 is armed with four missile launchers and the associated fire-control system and tows a semi-trailer with a further eight missile rounds. The short-term aim was to provide the 82d Airborne Division with some limited antiarmor capability after the retirement of its M551 Sheridan light tanks. The LOSAT is too large and cumbersome for widespread use, and the Army is attempting to develop a smaller missile called CKEM (Compact Kinetic Energy Missile) to replace it.

Another overly ambitious missile associated with the HMMWV was the MGM-157 Enhanced Fiber-Optical Guided Missile (EFOG-M). This consisted of a cell of vertical-launched missiles on the rear of an HMMWV, which were steered via a fiber-optic wire trailing from the vehicle. The original mission in the 1980s was for forward air defense against helicopters, but after the Cold War the mission was changed to precision strike against high-value enemy ground targets. It was the hope that a small, lightweight platform such as the HMMWV with the EFOG-M would give rapid-entry forces some immediate firepower until more conventional heavy artillery could arrive. After nearly 20 years of development, the program was finally killed in 1999. However, it was followed by a very similar program, sometimes called Netfires, which also uses a vertical missile launch cell on the back of an HMMWV, but with a wireless guidance technology.

The MGM-157 EFOG-M was an effort to exploit novel fiber-optic guidance for a vertical-launch precision attack missile. It was canceled in 1999, but the concept re-emerged a few years later as Netfires. (Raytheon)

ELECTRONIC HMMWVS

The HMMWV has been the chassis of choice for a very wide range of US Army electronics equipment due to its ability to transport the standard S-250 shelter. The most common of HMMWV electronic variants are radio communication vehicles, widely used in all Army units. Electronics versions are less well known due to the greater popular interest in close-combat variants, as well as the secrecy attached to some of these electronic systems. With the US Army moving into an age of "information warfare" based on the networking of units using digital command-and-control systems, electronic systems are playing a growing role on the modern battlefield. The HMMWV is used to carry a wide variety of electronic technologies for command-and-control, intelligence collection, and other roles. Among the electronic systems using the HMMWV for mobility are the Aerial Common Sensor (ACS), Common Ground Station (CGS), Air/Missile Defense

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Planning and Control System (AMDPCS), All Source Analysis System (ASAS), Defense Satellite Communications System (DSCS), Digital Topographic Support System-Light (DTSS), Integrated Meteorological System (IMETS), Forward Area Air Defense Command and Control (FAAD C2), Integrated System Control (ISYSCON), Joint Biological Point Detection System (JPBDS), Joint Service Lightweight Nuclear Biological Chemical Reconnaissance System (JSLNBCRS), Joint Service Lightweight Standoff Chemical Agent Detector (JSLSCAD), Joint Tactical Ground Station (JTAGS), Prophet signals intelligence sensor, Secure Mobile Anti-jam Reliable Tactical Terminal (SMART-T), Super High Frequency Terminal, Tactical Electric Power (TEP) system, Tactical Exploitation System (TES), Tactical Operation Centers (TOC), Trojan Spirit satellite communications system, and the Tactical Unmanned Aerial Vehicle (RQ-7A Shadow) ground control station.

FURTHER READING

This book was based on a variety of US Army documents and reports, including various editions of the annual Army Research, Development, Testing, and Evaluation (RDT&E) and procurement descriptors, annual Army reports, after-action reports, technical manuals, and other unclassified documents. Another useful source of information was AM General publicity brochures that the author gathered over the years at various international shows, including the annual Association of the US Army (AUSA) convention in Washington, DC, Eurosatory, IDEX, and others. There is a modest assortment of books dealing with the HMMWV, not enough to challenge the enormous library on the jeep, but certainly growing every year. Some of those dealing with the military versions of the HMMWV are listed below.

Frantisek Koran, *M998 HMMWV in Detail* (WWP: 2001). This is a photo album aimed mainly at modelers, with many excellent detail photos of the HMMWV.

Jim Mesko, *Hummer in Action* (Squadron: 1994). A photographic survey with good coverage of early HMMWV combat use in Panama and *Desert Storm*.

Bill Munro, *HMMWV* (Crowood: 2002). This is one of the first detailed histories of the HMMWV, and a very good start.

Carl Schulze, *HMMWV: Workhorse of the US Army* (Concord: 2002). This is one of the best of the photo albums on the HMMWV, containing an excellent assortment of color photos of the HMMWV in use around the world and including coverage of some of the rarer examples from Morocco, Djibouti, the UAE, and elsewhere.

Francois Verlinden, et al., *M998 HMMWV and Derivatives: War Machines No. 7* (VP: 1991). This is a small photo album aimed mainly at modelers, which also includes useful illustrations from the technical manual.

COLOR PLATE COMMENTARY

A: M966A1 TOW CARRIER, 1ST BRIGADE COMBAT TEAM, 101ST AIRBORNE DIVISION, MOSUL, IRAQ, 2003

At the time that the HMMWV entered production, the US Army was shifting to NATO standard "Central European" camouflage for its vehicles. Here is a three-color scheme with the base color being FS30051 Green, with added FS34094 Brown and FS37050 Black. The green color is used overall on the vehicle, including the interior, while the exterior is finished in a standard, factory-applied camouflage pattern with the brown and black added. The chassis and powertrain are painted black, and in most cases the wheel hubs are black as well.

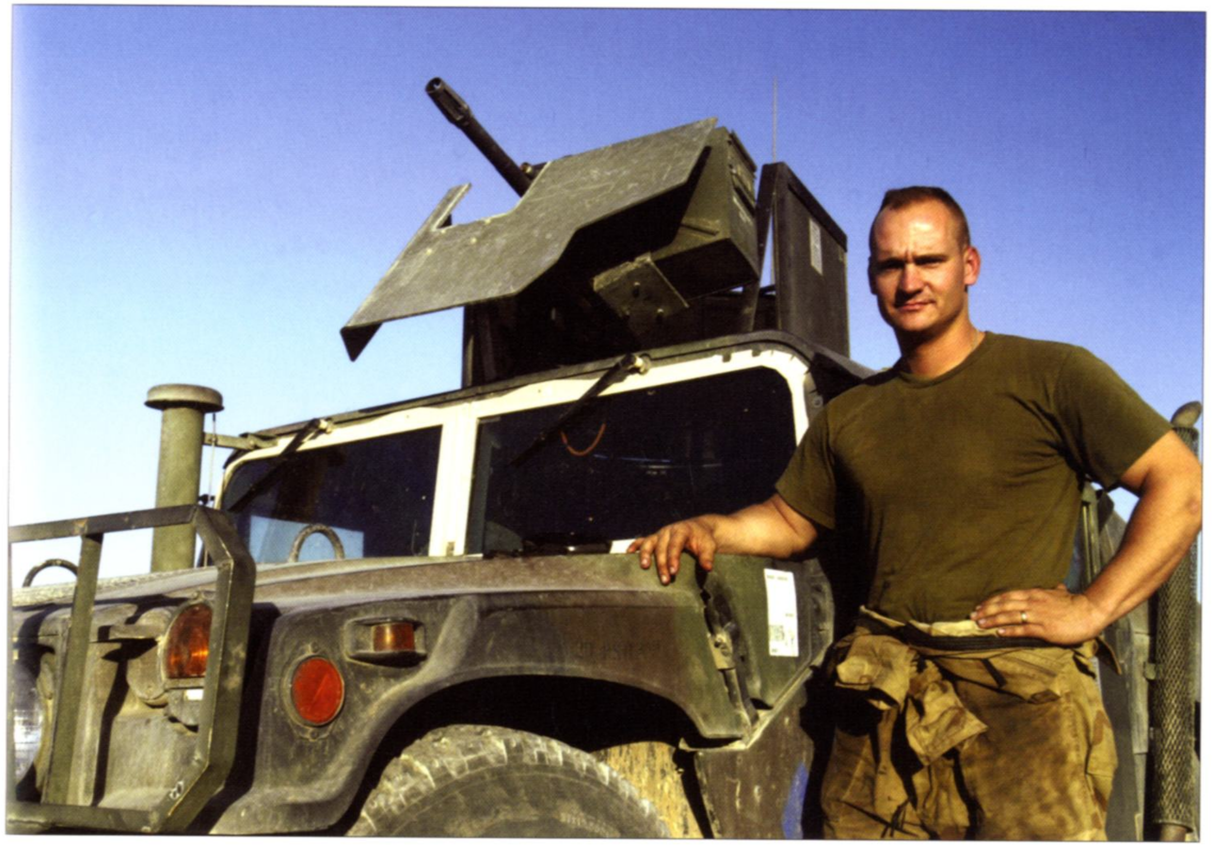
Since Operation *Desert Storm*, the US Army has used the "spinning V" chevron insignia, with the general use being to identify platoons: 1st Platoon (^); 2nd Platoon (>); 3d Platoon (v). HQ platoons often use two chevrons (<>) and other combat elements use two chevrons pointing up and down, as seen here with this antitank platoon. A two-digit tactical number that varies in meaning usually accompanies these markings. Often, the first digit indicates the battalion (1–3 for 1st Brigade; 4–6 for 2d Brigade; 7–9 for 3d Brigade; 0 for divisional elements), while the second number identifies the company (1 = Company A; 2 = B; 3=C; 4 = D). However, this pattern varies from division to division and has varied over time. In the case here, it has been painted on the vehicle in the common CARC Tan (FS33446 Tan), which is the standard single-color paint for desert camouflage.

The "spinning V" insignia should not be confused with the coalition forces insignia, which is an upward-pointing chevron painted in larger fashion than the tactical marking.

B: M1109 HEAVY HMMWV, HQ, 1/1ST CAVALRY, 1ST ARMORED DIVISION, TASK FORCE EAGLE, OPERATION *JOINT ENDEAVOR*, BOSNIA, 1996

The 1st Armored Division provided elements to Task Force Eagle, the NATO organization composing the Implementation Force (IFOR) to monitor the peace in Bosnia in 1996. The various international elements of IFOR retained their own markings and camouflage, but all vehicles were prominently painted with IFOR in white. This headquarters vehicle is finished in the usual style of US Army-Europe markings, including the standard NATO three-color Central European camouflage. The bumper codes are the usual US Army-style (1▲1Cav-1 HQ-6) and are painted in black on a CARC Tan rectangle. The European-style yellow/red rear corner markers

There were numerous local initiatives in Iraq to add better protection to the HMMWV. Sgt Phillip Zacher from 3/24th Marines at Camp Taqaddum developed this crow's nest to provide side and rear protection for the gunner in addition to the existing standard gun shield. The unit fielded 20 of these in June 2004. (US Marine Corps)



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are painted on the rear and the vehicle also carries the typical two-digit tactical numbering on the side. The rectangle resembling a venetian blind is a Combat Identification Panel (CIP) adopted after Operation *Desert Storm* in 1991. The panel is made in a non-magnetic metal that appears different from the rest of the vehicle when viewed through a thermal imaging night sight, and is used as a means of night identification.

C: M997A1 MAXI-AMBULANCE, UAE KFOR CONTINGENT, MULTI-NATIONAL BRIGADE (NORTH), KOSOVO, 2000

The United Arab Emirates dispatched a military contingent to take part in the Kosovo Force (KFOR) peacekeeping operations in 2000, which served with the French-led MNB(N). The UAE Army HMMWVs are normally finished in CARC Tan with a camouflage pattern of pale brown splotches. On arrival in Kosovo, they were repainted in NATO Central European camouflage. However, the pattern is not the standard US factory pattern, but simply a local expedient. The UAE ambulances carry insignia of the Red Crescent, the Islamic equivalent of the Red Cross. Other markings include the usual coalition forces white chevron, a UAE Army license plate, and the UAE flag on a metal plate on the right bumper.

D: M1045 TOW CARRIER, 15TH MARINE EXPEDITIONARY UNIT (SPECIAL OPERATIONS CAPABLE), KANDAHAR, AFGHANISTAN, DECEMBER 2001

See plate for details. Deep wading exhaust omitted for clarity.

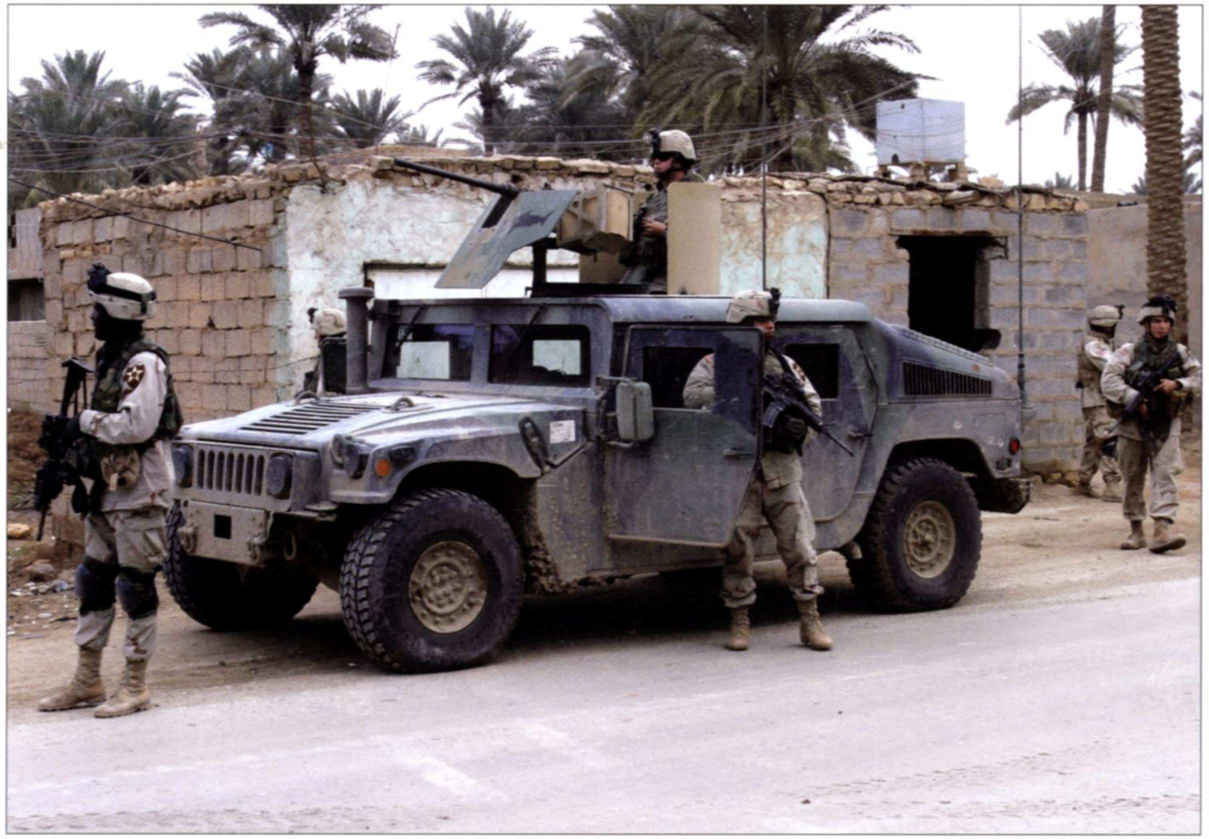
E1: M1114 UAH, 87TH INFANTRY, 10TH MOUNTAIN DIVISION, ORGUN-E, AFGHANISTAN, APRIL 2004

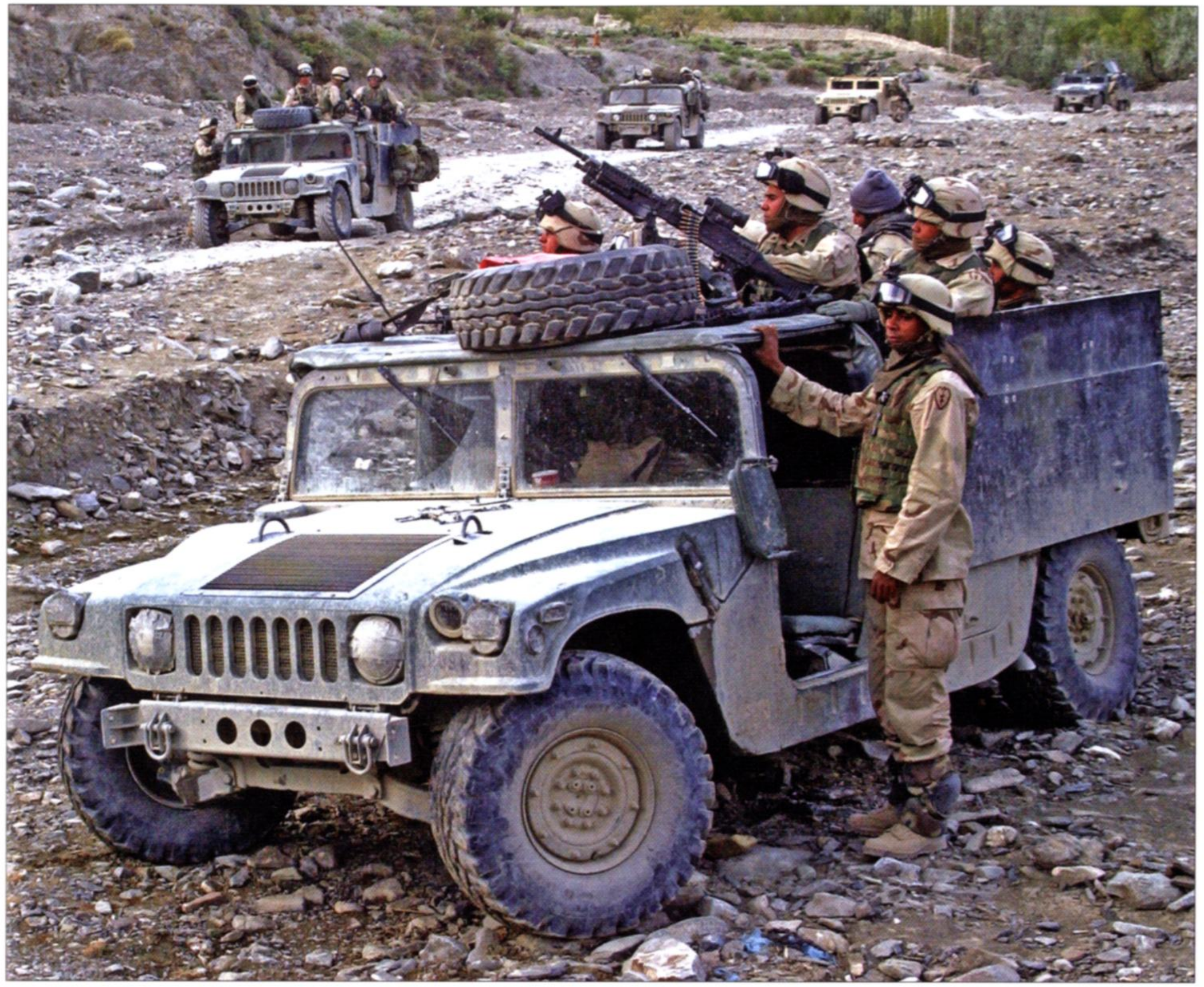
Following Operation *Desert Storm*, the US Army shifted its vehicle camouflage policy and some units allotted to possible operations with Centcom (Central Command) were finished in CARC Tan, the same desert tank color used on US vehicles in the 1991 war. As a result, some new production equipment was delivered in uniform CARC Tan, a common choice with the M1114 UAH. In this particular case, the uniform color has been broken up by a pattern of black lines to form a simple improvised camouflage scheme.

E2: M1114 UAH, TROOP C, 1/11TH ARMORED CAVALRY REGIMENT, BAGHDAD, MARCH 2005

Many of the M1114 UAHs that arrived in the summer and fall of 2003 were finished in overall CARC Tan as seen here. The camouflage scheme is broken up somewhat on the sides by the black gasket running around the doors. Tactical markings during peacekeeping operations in Iraq have tended to be simple, in this case the C indicating Troop C painted on the side of the door.

The HMMWV hardening program in Iraq involved local initiatives like this M1114 UAH of the Army's 1/503d Parachute Infantry Regiment (PIR) attached to the 1st Marine Division, which has had a Marine circular gunner's shield welded to the weapon station for added protection. The paratroopers are seen here during patrols near Ar Ramadi in March 2005. (US Army)





An M998A1 soft-cab troop carrier of 2/27th Infantry passes down a river gully near Orgun-E, Afghanistan, during a patrol on April 20, 2004. The unit has added its own steel armor appliqué to protect troops in the rear bed. (Spc Gul Alisan, US Army)

F1: M1044A1, THAI CONTINGENT, MULTI-NATIONAL DIVISION (CENTRAL SOUTH), IRAQ, 2004

The Multi-National Division (Central South) was an extremely polyglot formation. Its core consisted of elements of the Polish 12th Mechanized Division from Szczecin, to which were attached a variety of units from 19 other nations. Among these was a small detachment of 87 soldiers from Thailand, officially designated as the Thai Humanitarian Assistance Task Force 976/Iraq. This unit was involved mainly in non-combat engineer operations such as construction work, but it operated a number of armed HMMWVs including this one armed with a Mk 19 40mm grenade launcher. The Task Force's HMMWVs were painted in the usual CARC Tan, but carried a small Thai flag insignia on the door. A number of other MND (CS) units operated HMMWVs in Iraq, including units from El Salvador.

F2: M1114 UAH, SLOVENIAN ARMY, 2002

The Slovenian Army is one of the international operators of the HMMWV, including the M1114 UAH. As seen here, the M1114 follows local camouflage practice rather than the more common NATO Central European pattern. The Slovenian Army scheme uses the same green and brown colors as the NATO scheme, but substitutes an olive drab instead of black. The national insignia in the form of a shield is painted on the door, but in subdued camouflage colors instead of the actual red-white-blue.

G: M1114 ZEUS-HLONS, BAGRAM AIR BASE, AFGHANISTAN, 2003

The Zeus-HLONS solid-state laser system was first deployed into a combat theater in March 2003 to deal with mines and unexploded ordnance around Bagram air base. The basic vehicle is an M1114 UAH, although the back doors have had their windows plated over to make it easier for the laser operator is see the display screen on the control console. The laser, laser chiller, and power source are located in the rear bed of the truck, and the fire-control sights, beam controller, and optical port are mounted in a small turret over the operator's compartment in the center of the vehicle. The vehicle is painted in the usual CARC Tan and carries no distinctive markings.

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INDEX

Figures in **bold** refer to illustrations

Aberdeen Proving Ground 7, 22, 34
Afghanistan **16**, **17**, **18**, **33**, 37, **47**, **D**, **E1**, **G**
Alvis (now BAE Systems) Shadow 18
AM General **5**, 6, **7**, 7, 8, 14, 18, 21
Angola **12**, 12
Armor Holdings Inc. 34, 35
Australian Army **11**

Bosnia **20**, 22, 39, 41, **B**

Chevrolet Blazer 4, 8
Chinese versions 40–41
Chrysler Defence 6
COHHV (Cab-Over HMMWV) **20**, 21
combat, service in 11–14
  see also operations
Combat Support Vehicle (CSV) 5, 7

Eisenhardt 21, 22, 34
equipment
  Laser, Solid State (SSL) 37
  Laser Ordnance Neutralization System, Zeus 37, **G**
  reconnaissance equipment package, M707 Knight 16
  Sheriff Vehicle Mounted Active Denial System (VMADS) 36
  Surveillance System, Long Range Advanced Scout (LRAS3) 16–17
  tire inflation system, central (CTIS) 20
  Weapon Station, Crew Remotely Operated (CROWS) **35**, 36
exercises **11**, **19**
Expanded Capacity Vehicle (ECV) 21–22, 38

General Dynamics Land Systems (GDLS) **6**, 6, 7
General Motors 14

HMMWV (High Mobility Multipurpose Wheeled Vehicle)
  21st-century 37–39
  armor 10–11, 21–22, 24, 33–35, **34**, **35**, **36**, 36
  Avenger, PMS 14–15, **15**, **16**, 39, 41
  "Dumvee" Desert Mobility Vehicle **17**, 17–18
  electric hybrid 38–39
  electronic 43–44
  engines 7–8, 20, 22
  first-generation 8–11
  "green" 19–20
  Group I/II production batches **7**, 8–11
  hardening 33–36
  Heavy Variant (HHV) 18–19, 21
  international 39–41
  missile **41**, 41–43
    see also HMMWV Avenger; weapons
  origins 3–8
  problems 7–8, 36–37
  Scout program 15–18
  trials begin 7
  variants 14–20
    M966 TOW carrier **7**, 9, **11**, 21
    M966A1 19, 21, **23**, **A**
    M973 Stinger carrier 14, 21
    M996 mini-ambulance **10**, 10, 21
    M997 maxi-ambulance **10**, 10, 21
    M997A1 21, **C**
    M998 troop/cargo carrier 8, **9**, 9, 18, 21, 38
    M998A1 18, **19**, 19, 21, **22**, **47**
    M1025 armament carrier **9**, 10, 21
    M1025, adapted ("Dumvee") **17**, 17–18
    M1025A1/A2 16, 21, **39**
    M1026 armament carrier 10, 21
    M1035 mini-ambulance 11, 21
    M1036 TOW carrier 9, 19
    M1037 shelter carrier 10, 18, 19, 38
    M1038 troop/cargo carrier 8–9, **9**, **18**, 21, 38
    M1042 shelter carrier 10, 18
    M1043 USMC armament carrier **9**, **10**, **11**, 11, **13**, 21
    M1043A1/A2 **19**, 21, **24**, **36**
    M1044 USMC armament carrier 11, 21
    M1044A1 21, **F1**
    M1045 USMC TOW carrier **11**, 11, 21, **23**, **D**
    M1046 USMC TOW carrier 11, **18**, 21
    M1097 cargo/troop/shelter carrier 18, 19, 21
    M1097R1 38
    M1109 armament carrier 15, 21, **B**
    M1113 cargo/troop/shelter carrier 21, 22
    M1114 armament carrier **3**, **20**, 21, 22, 24, 33, **34**, **35**, 36, 37, **38**, 42, **46**, **E1**, **E2**, **F2**
    M1114 Zeus-HLONS **G**
    M1115 TOW carrier 21, 22
    M1116 USAF security 21, 22, **33**
    M1145 USAF forward air controller 22
    M1151 armament carrier 21, 38
    M1152 cargo/troop/shelter carrier 21, 38
  variants by sub-type 21
    -A1 series (Heavy Variant) **18**, 19, **19**, 21
    -A2 series **20**, 20, 21, **38**, 38
  Vismod (Visual Modification) **17**
Hummer civilian vehicles 3, 7, 14, 19–20
Hussein, Uday and Qusay **23**

Iraq, post-war **24**, 33–36, **35**, **36**, **38**

Kosovo 41, **C**

M3 Cavalry Fighting Vehicle (CFV) 15
M151 Mutt -ton 4x4 truck 4, 5, 6, 8, 13–14, 23
M561 Gama Goat 1-ton 6x6 4, 5, 6, 13–14, 23
M715 1-ton truck 4
M880 -ton truck, Dodge 4, 13–14
M1008/M1009 Commercial Utility Cargo Vehicle (CUCV) 8, 13
Military Systems Group 17–18
MOWAG Eagle 39–40, **40**

O'Gara-Hess 21, 22, 34, 35
operations
  Al Fajr **24**, **35**
  Avalanche **3**
  Desert Storm **13**, 13, 15, 17, 18–19, 39
  Final Assault 12
  Iraqi Freedom **22**, 22–24, **23**, 33, **A**, **E2**
  Joint Endeavor **B**
  Joint Guard **20**
  Just Cause 11
  Restore Hope 21
  Uphold Democracy 21
Otokar Cobra **40**, 40

Panama 11–12
Poland, 18th Air Assault Battalion 39

Schwarzenegger, Arnold 14
shelter, S-250 10, 43
Slovenian Army **F2**
Spain 39
Swiss Army 39–40

tanks **24**, 24
Teledyne Continental 6, 7
Thai Contingent, Multi-National Division (Central South) **F1**
TOW carrier concept, AM General **7**, 9
  see also weapons

UAE Army **39**, 39, 41, **C**
US Air Force 8, 14, 22, **33**
US Army
  Air Defense Artillery, 3/62d, Battery B **16**
  Airborne Division, 82d **9**, 11, 42
  Airborne Division, 101st **23**, **A**
  Armor, 1/34th, Cobra Company 24
  Armor, 2–63d **38**
  Armored Cavalry, 2d **20**
  Armored Cavalry Regiment, 1/11th, Troop C **E2**
  Armored Division, 1st 45
  Army Research Lab 34
  Cavalry, 1/1st, 1st Armored Division **B**
  contract awarded 8
  Ground Systems Industrial Enterprise (GSIE) 34
  Infantry, 6th 11–12
  Infantry, 2/27th **47**
  Infantry, 87th, 10th Mountain Division **E1**
  Infantry, 1/501st **3**
  Infantry Division (Mechanized), 3d **22**, 22
  Military Police Brigade, 18th 34
  National Training Center **10**, **17**
  Parachute Infantry Regiment, 1/503d **46**
  Parachute Infantry, 2/504th 11
US Marine Corps 8, **9**, **10**, 10–11, **11**, **13**, **19**, **23**, 23, 38, 41–42
  Marines, 3/2d **11**
  Marines, 3d **19**
  Marines, 2/4th **34**
  Marines, 2/11th **36**
  Marines, 3/24th **45**
  MEU (Special Operations), 15th **18**, **D**
  MEU, 26th **36**, 36
  up-armor package and MAK **36**, 36
US Navy 18, **24**
US Special Forces, 3d Group **17**, 17

weapons
  devices, improvised explosive (IEDs) 24, 34, 36–37
  Gatling gun, GAU-19/A 12.7mm **39**
  grenade launcher, Mk 19 40mm **10**, 10
  gun, M119 105mm light **18**, 18
  machine gun, .50-cal. 10, 12, 14
  missiles
    AIM-120 AMRAAM 41
    FIM-92 Stinger man-portable 14–15, **15**, **16**
    MGM-157 EFOG-M 42–43, **43**
    MGM-166A LOSAT **42**, 42
    TOW antitank 4, **7**, 9, **11**
  Mortar System, Singapore Technologies Super Rapid **39**
  recoilless rifle, 106mm **12**, 12

XM966 High Mobility Weapons Carrier (HMWC) **5**, 5, **6**
XR311 Cheetah design 7

Zacher, Sgt Phillip **45**

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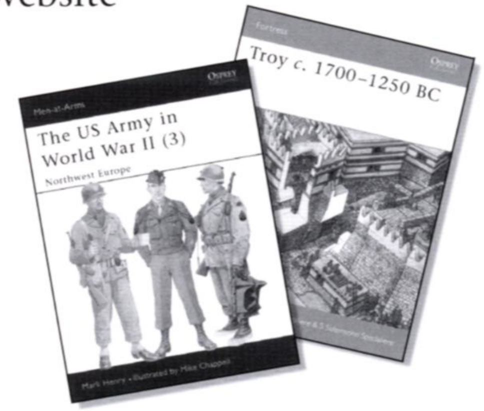

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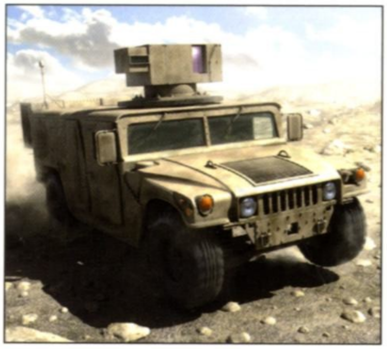

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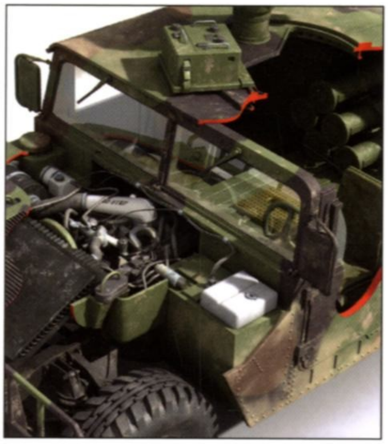

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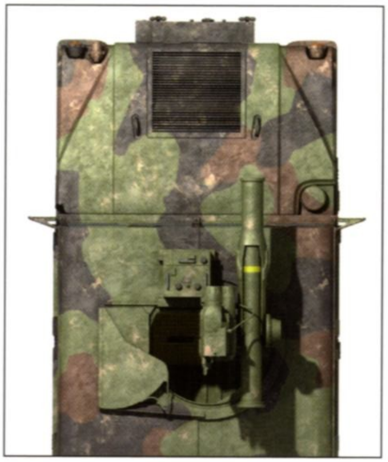

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US Army tactical vehicle

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